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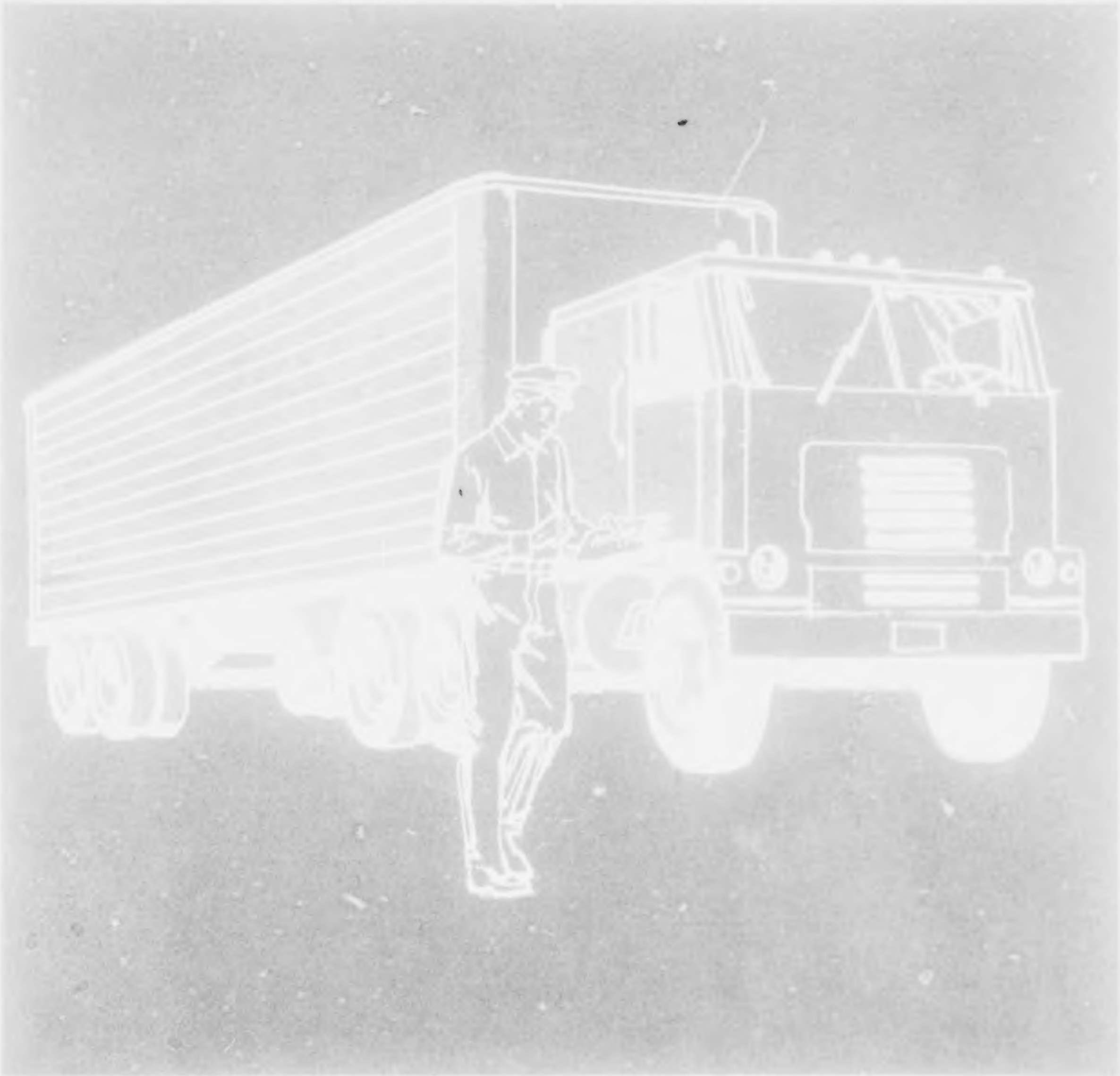
Model Curriculum for Training Tractor-Trailer Drivers

Instructor's Manual

Part One



Federal Highway Administration

TD 2.308:

Model Curriculum for Training Tractor-Trailer Drivers

Instructor's Manual Part Three

US Department
of Transportation
**Federal Highway
Administration**

Model Curriculum for Training Tractor-Trailer Drivers

Bureau of Motor Carrier Safety

1985

Instructor's Manual
Part One

U.S. Department
of Transportation

**Federal Highway
Administration**

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INSTRUCTOR'S MANUAL

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NOTE: All pages of this manual (except the introductory material) are numbered using a four-digit (number) code. Here is the meaning of this code:

FIRST DIGIT: shows the section number

SECOND DIGIT: shows the unit number (for that particular section)

THIRD AND FOURTH DIGITS: show the page number (for that unit of that section)

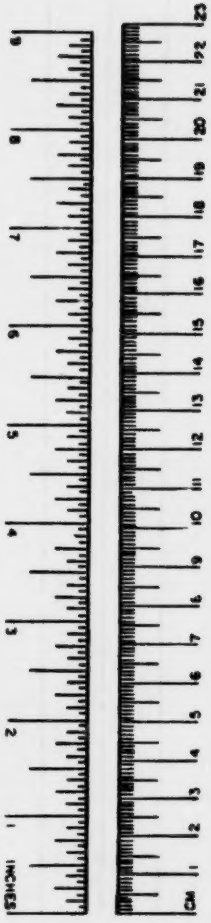
For example, the code 4.2 - 18 means:

Section number 4
Unit number 2
Page number 18

METRIC CONVERSION FACTORS

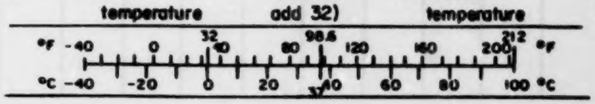
APPROXIMATE CONVERSIONS FROM METRIC MEASURES

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in²	square inches	6.5	square centimeters	cm²
ft²	square feet	0.09	square meters	m²
yd²	square yards	0.6	square meters	m²
mi²	square miles	2.6	square kilometers	km²
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons(2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft³	cubic feet	0.03	cubic meters	m³
yd³	cubic yards	0.76	cubic meters	m³
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



APPROXIMATE CONVERSIONS FROM METRIC MEASURES

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm²	square centimeters	0.16	square inches	in²
m²	square meters	1.2	square yards	yd²
km²	square kilometers	0.4	square miles	mi²
ha	hectares(10,000m²)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000kg)	1.1	short tons	
		VOLUME		
ml	milliliters	8.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m³	cubic meters	36	cubic feet	ft³
m³	cubic meters	1.3	cubic yards	yd³
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



Notes:

INTRODUCTION

INTRODUCTION

This Instructor Manual is part of the U.S. Department of Transportation's, Federal Highway Administration's, Bureau of Motor Carrier Safety (BMCS) Model Curriculum for Training Tractor-Trailer Drivers, hereafter referred to as the "Curriculum." The Curriculum also includes a Student Manual and a School Administrator's Manual. The contents of these three manuals are based upon the BMCS Proposed Minimum Standards For Training Tractor-Trailer Drivers, hereafter referred to as the "BMCS Standards." The objectives, content, methods, instructional times, materials, equipment and facilities specified in this Curriculum are in full compliance with the BMCS Standards and may be used as a guide to better comprehension of both the requirements and "spirit" of the BMCS Standards.

It should be emphasized that the BMCS Standards are minimum standards, therefore, this Curriculum is to be considered a basic or "core type" of curriculum. Graduates of this Curriculum cannot be considered fully trained, "ready to solo" type drivers. This can only be accomplished if the Curriculum is considerably expanded and enriched to provide both additional driving time and material pertinent to the particular driving job that the student is being trained for. Students graduating from this basic Curriculum will still need additional road experience and vocational type of training: (such as loading tankers, chaining down loads, etc.), under the guidance and supervision of an experienced, professional driver before being considered fully qualified to operate in interstate or foreign commerce (as required by Section 391 of the Federal Motor Carrier Safety Regulations).

How much additional experience, will obviously depend upon the individual's capacity to learn; how much the school expands/enhances the basic Curriculum; and the quality of instruction. Therefore, all schools are urged to carefully evaluate the specific job requirements that their students are being trained for and to add all necessary material to this Curriculum to enable the student to successfully meet those job requirements safely.

The Curriculum manuals have been placed in three ring binders to facilitate future updating as well as to enable schools to expand upon and/or enrich the materials herein.

Overview of the Curriculum

The four basic goals of this Curriculum are the same as those of the BMCS Standards, which are

- o Student safety (while in training)
- o Ability to drive safely (reduced collision potential)
- o Ability to drive legally (compliance with laws and regulations)

- Ability to drive efficiently (reduced fuel consumption and vehicle abuse)

The Curriculum consists of five major sections. Each section contains a number of units, which in turn contain a number of individual lessons.

Sections

The five major sections of the Curriculum are as follows:

Section 1 - Basic Operation--This section is concerned with the interaction between students and the vehicle. It is intended to enable students to control the motion of the vehicle, make sure it is in proper operating condition, and correctly coupled to trailers.

Section 2 - Safe Operating Practices--This section is concerned with the interaction between the student/vehicle combination and the highway traffic environment. It is intended to enable students to apply their basic operating skills in a way that ensures their own safety and that of other road users.

Section 3 - Advanced Operating Practices--This section is concerned with the higher level skills needed to cope with the hazards of the roadway-traffic environment. Its purpose is to develop the perceptual skills needed to recognize the potential hazard as well as the manipulative skills needed to handle the vehicle in an emergency.

Section 4 - Vehicle Maintenance--This section is concerned with how the various components of the vehicle work so that you can recognize a malfunction or safety hazard before it can cause serious damage or an accident. Its purpose is to enable students to perform routine service functions and simple maintenance tasks, as well as how to recognize when the vehicle needs repairs.

Section 5 - Nonvehicle Activities--This section is concerned with activities that are not directly related to the vehicle itself, but which must be performed by tractor-trailer drivers. Its purpose is to see that these activities are carried out in a way that ensures safety to the driver, vehicle, cargo and other motorists.

Units

Instruction within each section is subdivided into units. A unit is a set of instructional activities having the same instructional objectives. The 29 units that make up the Curriculum appear in the outline on the next page. The nature and purpose of each unit will be described later.

CURRICULUM UNIT STANDARDS OUTLINE

	NUMBER OF LESSONS	MINIMUM HOURS REQUIRED				
		CLASSROOM	LAB	RANGE	STREET	TOTAL
SECTION 1 - BASIC OPERATION						
Unit 1.1 - Orientation	3	3.25	1.00	0	0	4.25
Unit 1.2 - Control Systems	2	1.75	.75	0	0	2.50
Unit 1.3 - Vehicle Inspection	2	2.00	4.00	0	0	6.00
Unit 1.4 - Basic Control	4	.75	0	7.25	0	8.00
Unit 1.5 - Shifting	2	1.25	0	3.00	0	4.25
Unit 1.6 - Backing	2	.75	0	22.00	0	22.75
Unit 1.7 - Coupling and Uncoupling	2	.75	0	3.50	0	4.25
Unit 1.8 - Proficiency Development: Basic Control	3	1.50	0	36.00	18.00	55.50
Unit 1.9 - Special Rigs	2	1.00	3.50*	0	0	4.50
TOTALS	22	13.00	9.25	71.75	18.00	112.00
SECTION 2 - SAFE OPERATING PRACTICES						
Unit 2.1 - Visual Search	3	1.25	.75	0	8.00	10.00
Unit 2.2 - Communication	2	1.25	0	0	3.00	4.25
Unit 2.3 - Speed Management	2	2.00	0	1.75	0	3.75
Unit 2.4 - Space Management	2	1.75	0	0	6.00	7.75
Unit 2.5 - Night Operation	3	.75	0	3.00	4.50	8.25
Unit 2.6 - Extreme Driving Conditions	2	3.25	0	4.00	0	7.25
Unit 2.7 - Proficiency Development: Safe Operating Procedures	2	1.00	0	0	70.50	71.50
TOTALS	16	11.25	.75	8.75	92.00	112.75
SECTION 3 - ADVANCED OPERATING PRACTICES						
Unit 3.1 - Hazard Perception	2	1.50	0	0	6.00	7.50
Unit 3.2 - Emergency Maneuvers	2	1.50	0	4.00	0	5.50
Unit 3.3 - Skid Control and Recovery	2	1.25	0	7.75*	0	9.00
TOTALS	6	4.25	0	11.75	6.00	22.00
SECTION 4 - VEHICLE MAINTENANCE						
Unit 4.1 - Vehicle Systems	2	11.25	2.00	0	0	13.25
Unit 4.2 - Preventive Maintenance and Servicing	4	1.25	7.50	0	0	8.75
Unit 4.3 - Diagnosing and Reporting Malfunctions	2	3.00	1.00	0	0	4.00
TOTALS	8	15.50	10.50	0	0	26.00
SECTION 5 - NONVEHICLE ACTIVITIES						
Unit 5.1 - Handling Cargo	4	5.00	4.00*	0	0	9.00
Unit 5.2 - Cargo Documentation	2	4.75	0	0	0	4.75
Unit 5.3 - Hours of Service Requirements	3	5.75	0	0	0	5.75
Unit 5.4 - Accident Procedures	4	13.00*	.75	0	0	13.75
Unit 5.5 - Personal Health and Safety	3	5.00	0	0	0	5.00
Unit 5.6 - Trip Planning	2	4.75	0	0	0	4.75
Unit 5.7 - Public and Employer Relations	2	4.25*	0	0	0	4.25
TOTALS	20	42.50	4.75	0	0	47.25
TOTAL	72	86.50	25.25	92.25	116.00	320.00

29 Units (Mandatory) and 72 Lessons (Optional)
* = Portions of time are optional

Lessons

Each unit consists of one or more lessons. A lesson is a group of similar learning activities taught under the same basic instructional methods. Lessons form the basic elements of the curriculum. Most lessons are taught in a single session. A few lessons, mostly range and street lessons, are taught in more than one session, spread out over several hours, and often several days. Each lesson is taught in one of the following modes:

> Classroom--Classroom instruction is instruction that takes place indoors, accompanied by instructional aids that allow large numbers of students to be taught effectively at one time.
>
> Lab--Laboratory instruction refers to any instruction taking place outside of a classroom that does not involve actual operation of the vehicle or its components. It may take place in a parking lot, garage, range or facility owned by a dealer or fleet operator.
>
> Range--Range instruction is instruction that takes place on a protected offstreet "Driving Range", where students may make use of tractor-trailers without hazard from cars or other road users. Those schools that lack access to offstreet facilities may conduct range instruction on a public highway provided there is adequate control of other traffic to avoid danger to students, instructors or other road users.
>
> Street--Street instruction refers to behind-the-wheel (BTW) instruction that takes place in roadway configurations and traffic conditions needed to satisfy the objectives of the lessons for which the instruction is required.

No one lesson involves more than a single mode.

Instructional Sequence

The first three sections of the Curriculum form a natural learning sequence beginning with basic control of the vehicle's motion (Section 1), adding to this activity the needs of the highway traffic environment (Section 2), and finally introducing the advanced skills (Section 3), that can only be acquired once the more fundamental skills have been mastered.

Units of Sections 4 and 5 are relatively independent and can be taught in any sequence. Because they involve primarily classroom and laboratory instruction, they may be scheduled concurrently with the Range and Street instruction of Sections 1, 2, and 3 so as to make the most efficient possible use of school equipment and facilities at all times.

CONTENTS OF MANUAL

The contents of this Manual includes the following:

- Unit Introduction
- Lesson Introduction
- Lesson Plans

Unit Introductions

To introduce each unit, the following information is provided:

Title--The number and name of the unit.

Purpose--A brief statement of the overall purpose of the unit.

Objectives--Listing of the performance, knowledge, skill, and attitude objectives for the unit.

Lessons--A listing of the lessons making up the unit, along with the time allocated to each lesson.

Type of Objectives

The objectives comprise the major portion of each Unit Introduction. They include the following types of objectives:

Performance Objectives describe the behaviors that students are to achieve on the basis of training.

Knowledge Objectives describe the knowledges that are needed to enable and/or motivate students to attain performance objectives.

Skill Objectives describe the perceptual, manipulative, and reasoning skills that must be attained through practice to achieve performance objectives.

Attitude Objectives describe the beliefs that students must hold in order to assure a high likelihood that performances will occur in actual tractor-trailer operation.

Nature of Objectives

The objectives appearing in the Unit introduction are the "real world" performances, knowledges, skills, and attitudes that tractor-trailer drivers need to perform safely and efficiently on the job. Since it is the purpose of the curriculum to lead students to attainment of these objectives, they also become the objectives of Unit instruction. The reasons for placing objectives in the Unit introduction, rather than at the beginning of each lesson, is that it often requires two or more lessons to permit students to obtain the objectives.

The Curriculum objectives are not the same as so-called "behavioral" objectives you may have seen before, which describe things that students are supposed to do during training, such as "The student must list . . .," "The student must explain . . . ." Behavioral objectives are not so much the objectives of instruction as they are a way of measuring what students have learned. Measures of student achievement are provided in the Tractor-Trailer Driver Curriculum Tests. The tests--described in another portion of this manual--consist of written tests, range skill tests, and onstreet tests designed to measure both in-course and end-of-course achievement. Objectives and test measures differ in that:

- The objectives encompass everything that is important to safe and effective driving, while the test includes only those things that can be measured within the time available and the limitations of valid test methodology.

- Objectives, being all-encompassing, must be stated in very general terms, while measures can be described in very precise terms.

- While it is frequently desirable to keep students from knowing exactly what they will be tested on, it is absolutely essential that they know in advance exactly what all the objectives are.

Lesson Introductions

To introduce each lesson, the following information is provided:

Title--The number and name of the lesson.

Overview--A brief overview of the lesson including the time allotted to it, the prerequisite, and the purpose of the lesson. Prerequisites are confined only to the last unit(s) in the sequence leading up to the lesson, but not all of the units, that together comprise the prerequisites.

Materials--A listing of the instructional aids and portions of the student material that will be used during the lesson, as well as any other items of printed material or equipment required.

Content--A listing of the activities and/or topics (in sequence) to be covered and the approximate amount of time necessary to cover each.

Lesson Plans

The bulk of the Manual consists of guidance in carrying out the instruction that makes up the curriculum. The content of the lesson plans varies according to the type of instructional activity: classroom, lab, range and street.

Classroom Lesson Plans

Classroom lesson plans provide the following:

Outline--A detailed outline of the subject matter that you are expected to cover.

Visuals--The number and title of each visual is placed where it should appear in the lesson. (Note: Visuals are found right after each Lesson Plan in the manual).

Instructions--Special instructions for carrying out certain classroom activities, such as demonstrations.

Laboratory/Range Lesson Plans

Lab and range lessons are divided into a number of specific exercises. For each exercise the lesson plan describes the following:

Purpose--A brief statement of the purpose of the particular exercise.

Layout--Instructions for setting up the exercise, including painting of lines, placing of traffic cones, positioning of vehicles, etc.

Direction--Instructions for carrying out the exercise.

Observations--The elements of student performance that the instructor observes to assess the student's performance.

Evaluation--Any criteria of overall performance to be employed to assess proficiency.

Street Lesson Plans

Street lessons also consist of exercises. For each street exercise, the lesson plan describes the following:

Purpose--A brief statement of the purpose of the exercise being performed.

Route--Characteristics of the road, traffic, and roadside environment in which the exercise should take place.

Directions--Instructions for managing the in-the-cab activity of student drivers and observers, e.g., method of conducting critiques, use of checklists, commentary driving, etc.

Observations--Elements of student performance that the instructor observes to assess the student's performance.

STUDENT MANUAL

Students are provided a manual to help them achieve the greatest possible benefit from the instruction they receive. The purpose of the Student Manual is not primarily to teach: it is not a textbook. What students learn about operating a tractor-trailer they learn from the instructor. The Student Manual is intended to help the instructor by providing the following three kinds of material:

> Overview--For each lesson there is an overview that identifies the objective of the lesson and the activities that will take place.
>
> Student Aids--Wherever students require written material in the course of a lesson, those materials are provided in the student manual. Some of the materials provide needed information (e.g., rules for street lessons, range diagrams) while others are intended for use by the students during the lesson (e.g., forms, checklists). Any time student materials are required during a lesson, the specific aid is listed at the beginning of the lesson plan under Student Materials.
>
> Text--While the student manual is not a textbook, it does provide instruction on those topics that may be difficult for some students to grasp entirely from classroom instruction. The purpose of the instruction is to enable the students to study in preparation for both classroom lesson and written examinations. The lesson plans indicate under Student Materials where text material is provided.

GENERAL INSTRUCTIONS

The lesson plans that make up the body of this Manual describe the specific things that are to be done in each lesson. However, there are a number of requirements for effective instruction that apply to several lessons. To save space and time, these general instructions are pulled together and listed under the following broad headings:

- Classroom lessons
- Lab and Range lessons
- Street lessons
- Remedial instruction
- Student evaluation

Classroom Lesson

The classroom lesson plan consists of a detailed outline of the subject matter to be covered. Here are some suggestions to help you do the best possible job of teaching the topics that are outlined.

Review Objectives

Before teaching any lessons, be sure to look over the objectives in the Unit introduction. Remind yourself of what the Unit is intended to accomplish. This will allow you to adapt the lesson plan to your students needs. It will also allow you to handle the problems and questions of students without straying from the scope of the Unit or digressing into subject matter that is covered in another Unit.

Review Content

You can't teach others what you don't know yourself! Before teaching any lesson the first time, go over the outline in detail. Allow yourself at least 2 hours for each hour of instruction. If some of the points mentioned in the lesson plan are unfamiliar to you, read up on the subject and get instruction and suggestions from your supervisor or a more experienced instructor. Make sure you know what each word in the lesson plan refers to, and be sure that you **thoroughly** understand all aspects of the subject.

Rehearse

After you are thoroughly familiar with the lesson plan, rehearse what you are going to say and what questions you are going to ask. Use the visuals so that you will know what to point out or what information you have to write on them. Time yourself and make sure you are not covering too much, in too short a period of time.

Preview Lesson Plan

Always read through the entire lesson plan quickly just before you teach a lesson as a reminder. This will help keep you from having to study the lesson plan while you are instructing or from missing important items. Be sure to read over the special instructions that appear under "notes" in classroom lesson plans.

Check Materials and Equipment Required

Be sure to check the requirements for materials and equipment in the lesson plan introductions to make sure you have what you need before you start the lesson. Count the number of visuals and compare it with the number in the lesson plan to make sure none are missing.

Involve the Students

The fact that the lesson plan is presented in outline form does not mean it is supposed to be a lecture. The quickest way to bore students is to do all the talking yourself. Even though students may not have driven a tractor-trailer, they are all automobile drivers and have experiences they can apply.

Ask questions that will draw information out of the students. Lessons are more interesting and information is retained longer when the students can participate.

Maintain Eye Contact

Try to keep eye contact with the students; don't keep your nose buried in the Lesson Plan (this is why it is so important to read though them ahead of time). The more you teach a lesson, the more familiar you will become with what is in it. As time goes on, you should need only a glance at the words that are underlined and in bold type.

Lab and Range Lessons

Although the action activity tends to shift from instructor to student in range and lab lessons, the involvement of the instructor should not slacken. It is important to manage student activity closely to make sure that everybody's time is being fully utilized. The following suggestions are intended to help you see that students extract the greatest benefit from their lab and range activities.

Check Materials and Equipment Required

Be sure to check in advance, all requirements for materials, equipment and vehicles for each Lab and Range Lesson (for in-depth descriptions of equipment and vehicle specifications check the School Administrators Manual). It is especially important to check over the vehicles to be used, as malfunctioning vehicles not only pose a serious distraction, they can also be a serious student safety hazard.

TECHNICAL INFORMATION NOTE: The dimensions shown for all Range Exercises, as well as for Range Tests are **only approximations**. These dimensions cannot be finalized until such time as the training standards have been validated. In the interim, these Range Lesson Plans can be used by modifying their dimensions as follows:

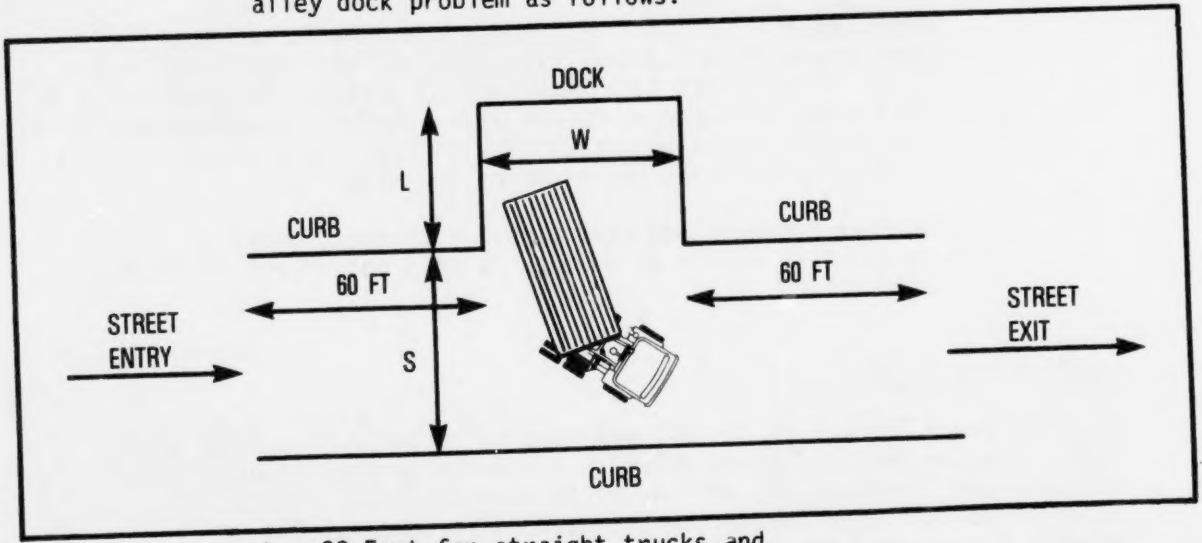
1. Secure current copies of the American Trucking Associations "Truck Roadeo Rules and Procedures (State and National competition)" and the "Truck Roadeo Course Diagrams and Roadeo Problems."

2. Review the Range Exercises in this manual. You will note that in most cases they specify an A. B. and C. dimension or measurement for location of barricades, curbs, traffic cones, etc. These signify three performance attainment levels, A. settings (the widest) are for novice or entry level students. The B. settings (slightly tighter) are for intermediate level students and the C. settings (the tightest of all) are for the advanced students. The objective is to start students at the A. settings and as they gain proficiency to move them up to the B. settings and finally to the C. settings, which are also used for the final range tests at graduation.

3. Generally no two rigs are exactly alike. For that reason, all settings on Range Exercises have to be modified to match the vehicle being used. This includes such things as vehicle type (3, 4 or 5 axles) the tractor's overall length, and length of wheel base, trailer length and wheelbase, fifth wheel location, kingpin setback, and the amount of trailer rear overhang, to list but a few.

4. To determine the actual settings for barricades, curbs, etc. for any particular exercise, first check the A.T.A. roadeo material for the roadeo problem that corresponds to that particular Range Exercise. The A.T.A. roadeo material will specify the dimensions of the exercise for most types of combination vehicles select the specifications that correspond most closely to your vehicle, and determine the problem dimensions therefrom. However, since you are setting up these exercises for students and not professional drivers, the A.T.A competitive roadeo settings will require modification down to the proper A. B. or C. student levels previously mentioned. This is done as follows, for the "A. Level" students expand the A.T.A. specified settings by 17 percent. For "B. Level" students expand the specified settings by 11 percent and for the "C. Level" (advanced students) expand the settings by 6 percent.

5. Example: The A.T.A. material shows settings for the standard alley dock problem as follows:



L = 30 Feet for straight trucks and
20 Feet for all tractor-trailers

W = 10 Feet for straight trucks and
11 Feet for tractor-trailers

S = 40 Feet for straight trucks and 3-axle tractor-trailers
S = 50 Feet for 4 and 5-axle tractor-trailers

To modify these settings for a 5-axle tractor-trailer (the "Standard" vehicle for this Curriculum), do the following:

"L Distance" = 20 feet, no modification should be made as this does not affect the difficulty of the exercise.

"W Distance" = 11 feet, since this does affect the difficulty of the exercise (the more narrow the dock space, the more difficult to back into it.) It must be modified (widened) for the students. In the case of A. Level students you must expand the width of the alley dock by 17 percent. Since 17 percent of 132 inches (11 feet) equals 22.44 inches you add 22 inches to 132 inches which equals 154 inches, which equals 12 feet, 10 inches. So the proper modification to the width of the dock for the A. Level students is now 12 feet 10 inches, instead of the 11 feet specified in the A.T.A. material. Following the same procedure, you find that for B. Level students the dock width will be expanded by 11 percent (from the original 11 feet) to 12 feet, 3 inches and for the A.Level student it will be expanded by 6 percent (from the original 11 feet) to a width of 11 feet, 8 inches (Note that all changes involving more than one-half inch are to be rounded up to the next full inch, those of less than one-half inch shall be rounded down).

"S Distance" = 50 feet, no modification should be made (even though it would make the exercise less difficult) as it is not realistic to expect to find a street greater in width than this under "Real Delivery World" circumstances. Furthermore, the level of difficulty has already been reduced by expanding the width of the alley dock.

"60 Feet Approach and Exit Curbs" = 60 feet, again no modification should be made as it does not affect level of difficulty.

Limit Demonstrations

Many lab and range activities are preceded by an instructor demonstration. The purpose of demonstration is primarily to show students how to carry out the exercise, not how to perform the task. (They are supposed to learn how to perform the task while in classroom and through the student material). One demonstration is generally sufficient. Any more time spent on demonstrations subtracts from the time available for students to practice.

Rotate Among Vehicles

Students should rotate among all the vehicles available to the school during range instruction. Students should never operate onstreet vehicles having a shift pattern or cab configuration unlike that which they have been exposed to during range instruction.

Maintain Control

With a number of vehicles operating simultaneously and in a confined area, it is necessary to maintain a high degree of control in order to assure safety and achieve effective learning. A set of range operating procedures is provided in the Student Manual. These must be strictly enforced. Breaches of discipline should result in suspension from class, while repeated or very serious breaches should result in expulsion from training. Such breaches include deliberately:

- Deviating from exercise paths.
- Knocking over cones and other markers.
- Interfering with the progress of other students.
- Abuse and/or damage of vehicles and other equipment.
- Unsafe acts

Keep Observers Involved

Simply watching another student perform does not qualify as training! Observer students (the students not actually performing the exercise) must be engaged in some form of learning activity if their time is to qualify as instruction. To help keep observers involved, you should

- have observers "score" driver performance by counting the cones knocked over, lane strips crossed, etc. (Observers should also reposition knocked over cones, flags and other markers.)
- remain with the observers to provide instruction whenever it isn't necessary to supervise the drivers directly.*
- discuss with the observers the strengths and weaknesses of the student driver's performances on each exercise, so that all may learn from their errors.
- wherever an activity is performed by a group (e.g., inspecting, coupling) rotate the responsibility frequently, and in a random manner, so that no one knows who is to be called on next.

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* The student actually carrying out an exercise activity will be generally referred to as "driver" even though some other activity may be involved (e.g., inspecting, servicing the vehicle, loading cargo, etc.)

Keep Students Challenged

Students develop proficiency more rapidly when the task is slightly more than they can handle easily. To maintain a high rate of learning, layout dimensions and exercise times should be tightened as students begin to show mastery of what they are doing, i.e., move students from the novice settings (A.), to the intermediate settings (B.) and to the advanced level settings (C.).

Adjust Practice to Need

The amount of practice needed to reach acceptable proficiency levels will vary considerable from one student to the next. To see that all students reach those levels, practice time should be varied among students. As individual students master a skill, their time should be reduced and given to the less proficient students.

Students who are slightly behind can be grouped together and allowed to practice more fundamental maneuvers in a portion of the range away from the other students. If possible, it would be best to schedule such students for After Hours special training sessions. An assistant instructor should be assigned to coach them in overcoming their deficiencies as quickly as possible.

Street Lessons

Street lessons are provided in Section 2 to allow students to apply the safe operating practices taught in the classroom. Specific procedures for conducting each street lesson are provided in the lesson plans. The following guidelines apply to all street lessons.

Assess Readiness

Each instructor is responsible for making sure that students are sufficiently skilled to permit safe operation on public streets. In meeting this responsibility, you should

- o make sure that students have taken and passed the Pre-Street Range Test provided.
- o remove from behind the wheel any student who, in your opinion, is not able to control the vehicle well enough to assure the safety of the instructor, students, and other road users.
- o check to make sure that each student has met all legal requirements in your State for a student, such as:
    - Chauffeur's License Learner's Permit
    - Eye Examinations
    - Written Test on Traffic Regulations

- During later phases of the onstreet training, it is recommended that overnight trips be taken. It is important to remember that if these trips involve crossing of State lines that all students participating in such trips must first become "U.S.D O T Qualified." That is, each student must have met all of the requirements as set forth in Section 391.11 of the Federal Motor Carrier Safety Regulations, in order for such a student trip to be legally conducted.

- For practice purposes, it is mandatory that all students keep and maintain a driver's duty status record, formerly called a driver's log book (as specified in Part 395 of the Federal Motor Carrier Safety Regulations) throughout the course. Thus it is recommended that Unit 5.3 be taught as early in the course as possible. Students should record all classroom activity as "on duty--not driving time," all time spent in an observer status while on the range and/or on street lessons should also be recorded as "on duty--not driving." All times actually spent behind the wheel, should of course be logged as "driving time." Any student trips that involve the crossing of State lines will require that all student's logs be kept up to the last change of duty status and that logs be neat and accurately kept.

- All student logs should be collected at the start of each day and graded (checked for accuracy). Students experiencing logging problems can thus be detected and given remedial training. Schools should keep such logs as a permanent record of which students have completed which sessions and/or not been given their share of BTW time as necessary to meet their minimum mileage requirements.

Stick to Objectives

Most of the street lessons are designed to achieve a specific set of objectives. These objectives concern particular safe operating practices, such as visual search and communication. Classroom instruction in these practices will have been given in the classroom lesson immediately preceding the street lesson. The routes, maneuvers, and checks for each street lesson are designed to focus upon the safe operating practices dealt with in class. It is important to keep this focus in order that students will have a chance to put to immediate use the practices they've learned in class.

You will notice in the street lesson plans that each lesson is cumulative, that is, each street lesson includes all of the safe operating practices taught in preceding lessons in addition to the one set of practices forming the objectives of the lesson being taught at the time. Of course, the routes chosen for any lesson are designed to emphasize the specific practices that form the objectives of the lesson being taught at the time.

Provide Feedback to Students

Throughout the street lessons, instructors and observer students should note and record errors made by the driver, using the instructor and observer checklists provided. Every 10-15 minutes (during early phases of onstreet lessons), the vehicle will be brought to a stop at a safe place and the driver's errors will be reviewed. You should call upon observers to report errors first, saving your comments for those errors overlooked by the observers. Later as student proficiency develops and/or less errors are being made it will be counter productive to make such stops, instead continue driving/training/observing while discussing the previous errors.

The purpose of the checklist is primarily to remind the instructor and observer students of the errors the driver has made. In critiquing the driver's performance, the observers and instructors should attempt to recall the specific nature of the error, where it was made, and what the correct behavior would have been. The checklist is not intended to score, rate, or otherwise evaluate driver performance.

You could, of course, point mistakes out to drivers as they arise. However, student drivers are typically too preoccupied with operating the vehicle to absorb such comments. It is better to wait until you can get the driver's total attention before attempting to provide a critique. The purpose of the checklist is primarily to help you and the observers to recall the errors that were made.

Using the checklist to record errors rather than both errors and correct responses is a matter of practical necessity. Since students will be responding correctly most of the time, trying to record their correct as well as incorrect responses would be almost impossible. Moreover, students will tend to learn more from having their oversights brought to their attention. However, this should not keep you from providing encouragement to students by recognizing as correct the things they do right.

Obviously, you can't comment on everything students do correctly -- you'd be talking all the time. However, you can commend them when they handle an out-of-the-ordinary situation particularly well. Examples of such instances would include anticipating the move of another driver, responding to a potential problem well in advance, or adjusting the position of the vehicle in order to prevent being hemmed in by other vehicles.

Vary Duration of BTW Sessions

Students will take turns driving. The optimum driving period during the early phases of instruction is 10-20 minutes. Stints of less than 10 minutes entail more switching of position than driving. After any more than 20 minutes of concentrated behind-the-wheel instruction, students tend to tire and thus become inattentive. Within these overall limits, the time allocated to each driving stint will vary as a function of the following:

Experience--Inexperienced students tend to tire quickly in early street sessions because of nervousness. As they get used to operating in traffic, the stints can become a little longer.

Driving Conditions--Heavy traffic, bad weather, and other stressful circumstances cause fatigue. The length of stints should be reduced under such conditions.

Proficiency--During the early training sessions, the more proficient students can be given shorter and fewer behind-the-wheel stints to offer more time for the less proficient students. However, this cannot continue as all students are entitled to the same amount of instruction.

During later phases of instruction, as students approach the end of Unit 2.7 much longer stints are appropriate.

Prior to graduation, students should experience at least one or two of the typical 4-to-5-hour continuous behind-the-wheel stints, that they will have to contend with on the job.

Keep Observers Involved

Observation time only counts as instruction if observer students are learning. Simply riding around in a truck will not produce learning. The purpose in having the observer students record and critique driver performance is to keep them involved in the learning process. Actually, in early onstreet lessons, most of the learning will occur while students are observers. Not having to cope with the task of maneuvering the vehicle, they are able to better observe, evaluate, and analyze the overall driving environment.

To make sure observers are paying attention and profiting from street lessons, you should call upon individual students to point out driver errors and to suggest what would have been appropriate responses. This will help keep nonparticipating students from hiding behind the observations of their fellow students.

Exploit Behavior of Other Drivers

The street environment offers an endless opportunity to witness more driver errors. Other drivers will generally exhibit a far wider range of mistakes than will the supervised student. Instructors can take advantage of these errors by having observers point them out when they occur and having students identify the effect that these errors could have upon other motorists, including themselves.

Instructor Demonstrations

To give students the maximum amount of behind-the-wheel, no instructor demonstrations are called for in the street lessons. However, schools having highly qualified street instructors can profitably devote the first 10 minutes of the first few onstreet lessons to a demonstration of the safe operating practices encompassed by the unit. Instructor demonstrations would be particularly valuable in those lessons involving reaction to other drivers, including:

Unit 2.1 - Visual Search

Unit 2.4 - Space Management

Unit 3.1 - Hazard Recognition

The commentary driving technique should be used by qualified instructors to teach students how to respond to different aspects of the highway-traffic environment.

Student's Solo Operations

During the last 10 hours (approximately) of Unit 2.7, those students who are considered capable and qualified should be given the opportunity to make "solo runs" (without an instructor) within the general vicinity of the school (State laws permitting). This is important to build self confidence. Many graduates complain that lack of a solo trip prior to graduation has made it difficult for them to pass preemployment road tests.

On solo runs the "driver" should be accompanied by another student who acts as a "driver's helper" and who from his vantage point in the right front seat, aids the driver whenever requested to do so - but otherwise remains silent and completes Unit 2.7 Safe Operating Practices Checklist which he/she then gives to the driver at the end of the trip. Solo runs should only be made over pre-selected, clearly defined routes with no detours allowed under threat of explusion from school. Thus it is relatively easy for instructors to "patrol" such routes to monitor student's operational skills and/or to locate a missing "overdue" vehicle that may have had a road breakdown or accident enroute. For obvious reasons, it is mandatory that vehicles used for student solo runs be equipped with 2-way radios to enable them to contact the school in case of problems while enroute.

Vehicles Used for Street Training

Obviously all vehicles used in onstreet training sessions should be in good mechanical working order. Particular attention should be paid to wheels, tires, brakes, lights, signals and steering. All vehicles must be equipped with seat belts for all occupants and all occupants shall be required to wear their seat belts at all times when the vehicle is on the highway. No exceptions!

Some schools recommended the use of "student driver" signs on the vehicle at least during the early phases of training. Others are very much against the use of student signs, however, some localities may require them, so regardless of your choice - check to see what the local legal requirements may be.

Vehicles used in onstreet training should be equipped with the very best rearview mirrors available for maximum safety. It is also recommended that additional "instructor mirrors" be added to cover any "blind spots" that the instructor may have on any particular vehicle.

Students should be rotated on a daily basis from vehicle to vehicle to gain maximum exposure to different type cab configurations, types of engines and drive trains, as well as types of trailers. During a majority of street lessons, the trailers should be loaded (see BMCS Curriculum Unit Standard 2.7 for details of minimum requirements) to give necessary experience with the differences between running loaded and empty. Good "cargo" to carry is scrap paper bales that usually can be borrowed or rented from a local paper dealer. Try for an approximate three-quarters load (e.g., 60,000 G.C.W.) for best results. Scrap paper bales make ideal cargo because they have a tendency not to move or shift and give a low center of gravity load.

If possible equip street training vehicles with 2-way radios connected to a base station at the school. This can be a very valuable tool for changing/adjusting schedules, gaining assistance quickly in case of a road failure or other emergency. Radios are mandatory for vehicles used in "convoy" and/or student solo type training trips. The FM type radios are probably better for this than CB radios as there will be less chance of interruption or busy channels.

Graduation Requirements

Prior to graduation, all students must have a minimum of 38.5 hours and 1,000 miles accumulated behind the wheel during the various street training sessions. Obviously some students will have more, others less, but in all cases each must have at least 1,000 miles and 38.5 hours.

This can easily be determined and/or documented by auditing the student's "driver's daily log books."

During the last 4 to 5 hours of Unit 2.7, the school may elect to conduct the street test portion of the final examination test battery, if it so desires. Miles operated during the test can be counted as part of the minimum 1,000 miles.

Driver's Record of Duty Status

Students must be required to maintain daily logs for all days in which onstreet driving occurs. Instructors should make sure, by use of spot checks, that all students have up-to-date books in their possession each time they participate in a street lesson.

Remedial Instruction

Students learn at different rates, depending upon their general ability and their aptitude for specific subjects. Students who are having a difficult time must be provided remedial instruction in order to fulfill instruction objectives and meet graduation requirements. The following suggestions are offered to assist in providing remedial instruction.

Adjust Instructional Time

When students must take turns engaging in instructional activity, which is usually the case in instruction outside the classroom, the time should be adjusted to give slower students additional practice. Obviously, additional practice can be provided slower students only at the expense of faster students. Care must be taken to make sure that students are not cheated of an opportunity to practice simply because they learn quickly, after all they have paid the same tuition. However, once the faster students have achieved the objectives of a particular lesson, there is not a great deal to be gained by providing additional practice. That time is better used by slower students.

Identify Sources of Trouble

Before attempting to provide remedial instruction, it is necessary to identify the source of student deficiencies. For example, a student's difficulty in steering a prescribed path may have nothing to do with steering, but rather may result from the student's failure to look far enough in front of the vehicle. Each range and street lesson plan identifies sources of some of the more commonly encountered student difficulties. Simply having students practice an activity, without correcting the causes of inadequate or incorrect performance, will not lead to improvement. In fact, having students practice under those circumstances can make it difficult to correct deficiencies at a later time.

Look for Physical and Mental Problems

All students must be screened before admission to school to make sure they are physically and mentally equipped to drive a tractor-trailer safely. However, screening tests cannot always identify all possible problems. The instructor should be alert to the following types of problems:

> Lack of Acuity--Students can pass a standard eye test and still not see well enough to drive safely. One common problem is the lack of "dynamic visual acuity," that is, the inability to see clearly while the vehicle is moving. Students who fail to respond to certain signs and signals or who don't react to potentially dangerous situations may not see well enough.

Night Vision--Daytime and nighttime vision are two different things. Some people lose the ability to see clearly as the level of light begins to drop. Others can see very well in the dark, but are easily blinded by the glare of headlights. Students who can drive well during the daytime, but have difficulty in nighttime sessions may have a nighttime visual problem.

Field of Vision--Some people have difficulty seeing things "out of the corner of the eye." Drivers who fail to notice the vehicle when they pull alongside may suffer from this problem.

Hearing--It is important to be able to hear well -- horns, screeching brakes, sirens, unusual engine noises, the transmission, and so on. Statistics show that drivers who have hearing problems tend to be less safe on a per-mile basis than drivers with normal hearing. Students who have to have instructions repeated or do not seem to grasp what is said may be suffering from a hearing problem.

Physical Strength--Driving a tractor-trailer is physically taxing. Drivers who cannot handle a 2- or 3-hour stint behind the wheel during training are not likely to be able to stand up to the rigors of interstate driving. Students who complain of fatigue, or show it in their driving, may have a physical problem.

Emotional Problems--Students who are unusually impatient, who "fly off the handle," or who exhibit other personality characteristics that do not go along with safe driving, are poor safety and/or employment risks regardless of how well they are able to handle the vehicle. Watch for students who are given to frequent emotional outbursts.

Mental Limitations--Many aspects of tractor-trailer operation are mentally very demanding (e.g., obtaining permits, cargo documentation, hours of service regulations). Students who are unable to grasp these subjects during training face a very limited job market.

Students who evidence one or more of these physical or mental limitations should be referred to the school administration for appropriate action.

Report Deficiencies

Students whose deficiencies cannot be corrected during regular class hours must be reported to the school administration so that they can be scheduled for special remedial instruction. A form for reporting remedial instruction requirements should be obtained from the school administration. In reporting the problems, it is important to describe student problems as fully as possible. The description should include (1) the specific performance deficiencies observed, (2) the suspected sources of the deficiencies, and (3) the type and amount of remedial instruction needed. In the case of suspected physical or mental problems, great care must be taken to avoid embarrassment to the persons involved. Reports to the school administration should be prompt, factual and confidential. Rights of personal privacy must be respected. Don't get involved in areas where you lack expertise. For example in the case of suspected visual acuity problem, don't state that the person needs glasses. Instead, state that a vision problem is suspected and that an examination by a medical visual specialist is recommended. Thereafter, allow the school administration to handle the problem.

TRAINING AIDS AND
LIST OF SOURCES

Model Curriculum for Training Tractor-Trailer Drivers

Instructor's Manual Part One

U.S. Department
of Transportation

Federal Highway
Administration

TRAINING AIDS AND LIST OF SOURCES

The following is a list of instructional aids that are available for use in conjunction with this course. Items are listed according to their applicability to the entire course, sections of the course or individual units. Note: These items have not been reviewed, hence no endorsement is made or implied of their suitability or accuracy.

Following the list of aids, are the addresses of the organizations from which these and possibly other items can be obtained.

Entire Course

Anatomy of a Safe Trip. National Safety Council, booklet, 20 pages

ATA Fleet Safety Service, American Trucking Associations, an annual subscription service containing standards, materials, loss prevention (safety) training material, reference manual

Carrier or Killer, Greater Los Angeles Chapter - National Safety Council, a 16mm film covering six main causes of truck accidents (weather, alcohol, pills, fatigue, speed, carelessness), 28 minutes

Company Roadeo Manual, American Trucking Associations, how to conduct a company truck roadeo and use of roadeo as a testing, training and recognition device, 17 pages

Driver Education Equipment Catalogue, American Automobile Association, a listing of items including many types of driver testing equipment, brake detonators (Unit 2.3), eye movement (check) mirrors (Unit 2.1), plus other classroom and driving range training aids, 33 pages

Driver Education Supplies Catalogue, Bumpa-Tel, a listing of films, projection equipment, classroom and range training aids and driver evaluation equipment, such as brake detonators and student eye check mirrors, 40 pages

Driver Trainer Manual, Private Truck Council of America, includes chapters on the driver trainer, effective teaching methods, safe driving rules and regulations, 63 pages

Driving Safety: Trucks, Library Filmstrip Center, filmstrip, color/sound, 60 frames, 17 minutes

Facts for Drivers, American Trucking Associations, in question/answer format covering safe drving, the FMCSR, fire-fighting and first aid, a pocket size booklet for training drivers

Federal Motor Carrier Safety Regulations (pocket size), American Trucking Associations, covers Parts 390-397 of the FMCSR and a digest of the Hazardous Materials Regulations

Entire Course (continued)

Federal Motor Carrier Safety Regulations Interpretations, Bureau of Motor Carrier Safety, booklet containing official interpretations of the FMCSR, August 1983 edition, 23 pages

Federal Motor Carrier Safety Regulations Pocketbook, J.J. Keller and Associates, Parts 390-397 of the FMCSR and a Compendium of the Hazardous Materials Regulations and Explanations

Federal Motor Carrier Safety Regulations Training Package, #A00800, National Audiovisual Center, 514 color slides, 8 cassettes and script

Film Rental Catalogue, Greater Los Angeles Chapter - National Safety Council, a listing of 1,500 films and video cassettes covering subjects in safety, health, training, supervision, traffic, first aid and commercial vehicle transportation, 60 pages

Fleet Safety Compliance Manual, J.J. Keller and Associates, a reference manual

Fleet Safety Training Aids Source Directory, J.J. Keller and Associates, listing of films, tapes, books, etc., for driver training, 59 pages

Motor Vehicle Driving Practices, J.W. Lord Publishing Company, contains a broad range of material on defensive driving practices, the driver's responsibility and foul weather driving practices, 64 pages

Pro-driving Attitudes, The Film Library, film, color, 13 minutes

Professional Truck Driver's Handbook, Private Truck Council of America, A digest of the Federal Motor Carrier Safety Regulations that drivers must know, illustrated, pocket size, 70 pages

Safety--A Way of Life, National Safety Council, film, color, 21 minutes

Safety and Training Film Catalog, International Safety Academy, 34 pages

Safety Equipment Catalogue, Direct Safety Equipment Company, a listing of items to support many areas such as driving range pavement markers (striping machines), traffic cones, barricades and personal protective equipment, 68 pages

Safety Management Products, Catalog, International Safety Academy (Texas), 9 pages

The Driver Safety and Education Training System, Transportation Industry Consultants, Inc., covers several areas, 125 pages

Entire Course (continued)

The Interstate Truck Drivers Handbook, J.J. Keller and Associates, Simplified Version of Driver's Responsibilities as required by the Federal Motor Carrier Safety Regulations, 80 pages

The Safety Makers, International Safety Academy, catalog of rental safety and training films, 24 pages

Truck Driver Training Manual, American Trucking Associations, a supervisor's guide for training fleet drivers, 85 pages

Truck Drivers Handbook, American Trucking Associations, covers such areas as driving rules, accident procedures, equipment care, public relations and courtesy, a pocket size booklet

3-D Driving Course, The Hartford Insurance Company, an advanced course in traffic safety for commercial fleet drivers

Section 1

ATA Truck Roadeo Course Diagrams and Problems, American Trucking Associations, this booklet is revised periodically and is essential to setting up realistic driving range problems for this training curriculum.

ATA Truck Roadeo Rules and Procedures - State and National, American Trucking Associations, revised annually, 106 pages

Stopping-Parking-Emergency Warning Devices, Transportation Industry Consultants, Inc., sound on slide.

Unit 1.1

The Professional Way: Defensive Driving, National Safety Council (Stock Number 298.60) covers the six point professional driving code in a 27 page pocket size booklet - although defensive driving is not taught in this unit it is useful for introduction to what professional driving is all about

Unit 1.3

Driver Inspection Report, American Trucking Associations, driver's daily vehicle inspection report forms in triplicate

Driver Pre-trip Inspection, Transportation Industry Consultants, Inc., sound on slide

Take the Trouble, Greater Chicago Safety Council, film, 16 mm, color, 13 minutes

Unit 1.3 (continued)

Take the Trouble, Greater Los Angeles Chapter - National Safety Council, 16 mm film on pretrip vehicle inspection, 13 minutes

Vehicle Inspection Report Form, J.J. Keller Associates, driver's daily vehicle inspection form, with step-by-step instructions on what to inspect

Unit 1.6

Better Backing, National Safety Council, 30 slides and script

Big Blind Spot (preventing backing accidents), National Safety Council, film 16 mm, color, 10 minutes

Let's Stop Here (parking), Greater Chicago Safety Council, film, 16 mm, color, 10 minutes

Look, Stop Backing Accidents, National Safety Council, booklet, 18 pages

Look, Stop Backing Accidents, National Safety Council, film 16 mm, B&W, 10 minutes

Unit 1.7

Hooking Up the Twin Trailer, National Safety Council, film, color, 11 minutes

Uncoupling the Twin Trailer, National Safety Council, film, 16 mm, color, 11 minutes

Unit 1.9

Hooking Up the Twin Trailer, Greater Los Angeles Chapter - National Safety Council, 16 mm film, 11 minutes

Uncoupling the Twin Trailer, Greater Los Angeles Chapter - National Safety Council, 16 mm film, 11 minutes

Section 2

A Matter of Adjustment, Greater Los Angeles Chapter - National Safety Council, 16 mm film, 10 minutes

Adapting to Conditions, The Film Library, film, color, 8 minutes

Always the Other Guy, American Trucking Associations, film, 16 mm sound, 20 minutes

City Driving, Transportation Industry Consultants, Inc., sound on slide

Section 2 (continued)

Deadly Driving Errors Series, "A Matter of Adjustment", National Safety Council, film, 16 mm, color or B&W, 10 minutes

Defensive Action, Indiana University Audio-visual Center, (defensive driving), film, 16 mm, B&W, 30 minutes

Defensive Driving--Managing Time and Space, American Automobile Association, leaflet (also under Section 3)

Driving the Interstates: Seven Skills for Safety, Greater Chicago Safety Council, Inc., film, 16 mm, 23 minutes

Emergencies In the Making, National Safety Council, (avoiding hazardous situations), film, 16 mm, color, 15 minutes

Evaluating Expressway Dynamics, Aetna, filmstrip and audiotape

Facts for Drivers, American Trucking Associations, booklet, 133 pages (also under Section 3 and Unit 5.4)

Freeway Driving is Different, American Automobile Association, film, 16 mm, color, 15 minutes

Freeway Driving Tactics, The Film Library, film, 16 mm, color, 16 minutes

I.P.D.E. Response Driving Course, Aetna, A complete course for defensive driving with student and instructor manuals

Intersections, Transportation Industry Consultants, Inc., sound on slide

Interstate Driving, Transportation Industry Consultants, Inc., sound on slide

Living with the Smith System, Greater Los Angeles Chapter - National Safety Council, 16 mm film or video cassette, 12 minutes

Passing, Being Passed and Meeting Other Vehicles, Transportation Industry Consultants, Inc., sound on slide

Personality and Perception, Aetna, (affects of personality on perception) filmstrip and cassette, color

Preventable - Yes or No?, Greater Los Angeles Chapter - National Safety Council, 16 mm film, 10 minutes

Question of Alternatives, North American Van Lines, 16 mm film or video tape program, color, 12 minutes

Rail-Highway Grade Crossings, Transportation Industry Consultants, Inc., sound on slide

Section 2 (continued)

Signs of the Times, Greater Los Angeles Chapter - National Safety Council, 16 mm film, explaining meaning, placement and importance to safe driving of highway signs, 7 minutes

Speed, Stopping and Following Distances, Transportation Industry Consultants, Inc., sound on slide

Split Second Decisions, National Safety Council, (avoiding emergency situations), film, color, 14 minutes

Spot the Driving Errors, National Safety Council, film, color, 13 minutes

The ABC's of Defensive Driving, Indiana University Audio-visual Center, film, 16 mm, 13 minutes

The Expert Seeing Series, National Safety Council, 5 different films

1. Aim High in Steering, 2. Get the Big Picture, 3. Keep Your Eyes Moving, 4. Leave Yourself an Out, 5. Make Sure They See You, All 16 mm color films, each one approximately 10 minutes long

The Final Factor, National Safety Council, (how different factors contribute to an accident), film, 16 mm, 14 minutes

The Iron Graveyard, Greater Los Angeles Chapter - National Safety Council, a 16 mm film on city driving, 10 minutes

The Magic Circles of Defensive Driving, National Safety Council, film, 16 mm, color, 10 minutes

The Magic Circles of Defensive Driving, Greater Los Angeles Chapter - National Safety Council, 16 mm film, 10 minutes

The Road Test 9 in 10 Drivers Can't Pass (Avoiding driving errors), Institute of Driving Behavior, booklet, 24 pages

Unit 2.1

Big Blind Spot, Greater Los Angeles Chapter - National Safety Council, 16 mm film or video cassette, 10 minutes

Look Ahead, Transportation Industry Consultants, Inc., sound on slide

Seeing Habits for Expert Driving, Ford Motor Company Film Library, filmstrip, record, and work book

Test Your See Power, National Safety Council, booklet

The Smith System of Space Cushion Driving (Commercial Vehicles), Greater Los Angeles Chapter - National Safety Council, 16 mm film or video cassette, 30 minutes

Training Your Eyes for Expert Driving, Institute of Driver Behavior, booklet, 14 pgs

Unit 2.1 (continued)

Visual Acuity Tester with Color Recognition, American Automobile Association, equipment

Unit 2.3

A Matter of Distance, Greater Los Angeles Chapter - National Safety Council, a 16 mm film demonstrating "Timed Interval Driving Technique", 10 minutes

A Matter of Speed, Greater Los Angeles Chapter - National Safety Council, 16 mm film, 10 minutes

Can You Stop in Time?, Greater Chicago Safety Council, film 16 mm, color, 10 minutes

Deadly Driving Errors Series, "A Matter of Speed", National Safety Council, film 16 mm, color, or B&W, 10 minutes

Pro Driving Tactics, Greater Los Angeles Chapter - National Safety Council, 16 mm film or video cassette, 15 minutes

Reaction Brakes and You, National Safety Council, film 16 mm, color, 8 minutes

Speed Management, North American Van Lines, 16 mm film or video tape program, color 10 minutes

Strategy and Tactics of Safe Driving, Intext, manual and transparencies

Tire Hydroplaning, New York State College Film Library, film, 16 mm, B&W, sound, 12 minutes

Too Fast for Conditions, American Trucking Associations, film, 16 mm, color, 13 minutes

Unit 2.4

A Matter of Intersections, Greater Los Angeles Chapter - National Safety Council, 16 mm film, 10 minutes

A Matter of Passing, Greater Los Angeles Chapter - National Safety Council, 16 mm film, 10 minutes

Compromise and Separate, Aetna, filmstrip and audiotape

Deadly Driving Errors Series, "A Matter of Distance;" "A Matter of Intersections;" "A Matter of Passing", National Safety Council, film, 16 mm, color, 10 minutes each

How to Pass Safely, National Safety Council, film 16 mm, B&W, 10 minutes

Intersection Safety, Greater Chicago Safety Council, film, 16 mm, color, 10 minutes

Unit 2.4 (continued)

Isolate and Stabilize, Aetna, filmstrip and audiotape

Space Management, North American Van Lines, 16 mm film or video tape program, color, 10 minutes

The Crossroads Crash, National Safety Council, film, 16 mm, B&W, 10 minutes

Unit 2.5

A Matter of Darkness, Greater Los Angeles Chapter - National Safety Council, 16 mm film, 10 minutes

Deadly Driving Errors, Series II, "A Matter of Darkness", National Safety Council , film, 16 mm, color, sound, 10 minutes

Driver in the Dark, National Safety Council, booklet

Driving at Night, National Safety Council, film, 16 mm, color, 10 minutes

Driving Under Special Conditions, National Safety Council, film, 16 mm, B&W, 25 minutes (also under Unit 2.6)

Night Driving Tactics, Auto Club of Southern California, film, 16 mm, color, 17 minutes

Night Driving Tactics, The Film Library, film, 16 mm, color, 20 minutes

Night Operations, North American Van Lines, 16 mm film or video tape program, color, 10 minutes

Night Sight Meter, American Automobile Association, (measures vision in darkness), equipment

Porto Glare, Intext, (portable night driving simulator), equipment

To Drive at Night, American Automobile Association, film, color, 13 minutes

Unit 2.6

Adverse Weather, Transportation Industry Consultants, Inc., sound on slide

Adverse Weather Driving, National Safety Council, slides and discussion questions, 10 minutes

Driving Under Special Conditions, National Safety Council, film, 16 mm, B&W, 25 minutes (also under Unit 2.5)

Unit 2.6 (continued)

Extreme Driving Conditions, North American Van Lines, 16 mm film or video tape program, color, 10 minutes

Keep Rolling with Safety in Winter Weather, National Safety Council, booklet, 16 pgs

Safe Driving in Bad Weather--Trucks, National Safety Council, film, 16 mm B&W, 16 minutes

Surviving Winter Driving, Greater Los Angeles Chapter - National Safety Council, 16 mm film, 10 minutes

The ABC's of Safe Winter Driving, Channing L. Bete Company, booklet

Winter Truck Driving, National Safety Council, film, 16 mm, color, 19 minutes

Winter Truck Driving Safety, National Safety Council (Stock Number 399.54), a 14 page booklet of training information based upon tests conducted annually by the Committee on Winter Driving Hazards

Section 3

Emergency Driving Tactics, Greater Los Angeles Chapter - National Safety Council, 16 mm film or video cassette on many common emergency driving situations, 18 minutes

Facts for Drivers, American Trucking Associations, booklet, 133 pgs (also under Section 2 and Unit 5.4)

Panic Preventer, National Safety Council, (discussion of highway emergencies), booklet

Safety On the Move: Truck Haulage Safety, Greater Los Angeles Chapter - National Safety Council, 16 mm film, 16 minutes

Skids Can Be Controlled, Liberty Mutual, film, 16 mm, color, 15 minutes

Spot the Driving Errors, Greater Los Angeles Chapter - National Safety Council, covers 30 driving errors using commercial vehicles, a 16 mm film with an answer checklist included, 15 minutes

The Professional Way: Defensive Driving, National Safety Council, (Stock Number 298.60) covers the six point professional driving code in a 27 page pocket size booklet

Unit 3.1

Hazard Perception, North American Van Lines, 16 mm film or video tape program, color, 12 minutes

Identify and Predict, Aetna, filmstrip and audio tape

Unit 3.1 (continued)

Impediments to Vision and Control, Aetna, filmstrip and audio tape

Perception of Driving Hazards, Shell Oil Co., film, 35 mm, color filmstrip and guide book

Putting it All Together (IPDE), California Traffic Safety Foundation, film

See-Think-Do, National Safety Council, 30 slides, color, script

Unit 3.2

A Split Second from Danger, Aetna, (dealing with imminent collisions), film and discussion guide; driver improvement services.

Brake Detonator, American Automobile Association, equipment

Defensive Driving-Managing Time and Space, American Automobile Association, (covers evasive tactics), leaflet

Emergency Driving Tactics, Greater Chicago Safety Council, film, 16 mm, color, 18 minutes

Emergency Maneuvers, Ford Motor Company Film Library, filmstrip/records

Reacting to Emergencies, Aetna, filmstrip

Unit 3.3

Six Deadly Skids, National Safety Council, film, 16 mm, color, 26 minutes

Skid Control and Recovery, North American Van Lines, 16 mm, film or video tape program, color, 13 minutes

Surviving Winter Driving, Greater Los Angeles Chapter - National Safety Council, 16 mm film or video cassette, 10 minutes

Section 4

ABC's of the Diesel Engine, General Motors Corp., film, 15 minutes

Air Brake System-Part 1, Bendix, 35 mm slides, cassette, meeting guide, handout material

Air Brake System-Part 2, Bendix, 35 mm slides, cassette, meeting guide, handout material

Air Brake System Maintenance, Bendix, 35 mm slides, cassette, meeting guide, handout material

Vehicle Maintenance Records, J.J. Keller and Associates, many different types of records and forms

Section 4 (continued)

In addition to the above materials for Section 4, catalogs of instructional aids can be obtained from the following companies:

Audio-Visual programs on ignition systems, Standard Motor Products

Bulletin 79-3387109; Service Training Aids Publications Parts Catalogs, Cummins Engine Co.

Clark 5 Speed Manually Shifted Transmissions, Clark Equipment Co., 35 mm slides and script

Fuel Injection Pump Wall Charts, American Bosch

Information Regarding Electrical Systems, The Prestolite Co.

Slide/Cassette Programs and Cutaway Turbocharger Displays, Roto-Master

The Care and Feeding of Diesel Engines, CAV Simms Bryce, booklet

The Long Haul (oil filters); Go Heavy Duty (oil filters), AC Spark Plugs, super 8 mm films, 15 minutes each

Theory of Operation of Axle Differentials, Clark Equipment Co., 35 mm slides, script and 2 cassettes.

Wall Charts and Other Information on Vehicle Systems, Mack Trucks, Inc.

All tractor manufacturers have service manuals and shop manuals which contain excellent information and illustrations. Contact the manufacturer or local dealer for information on how to order.

Section 5

A Truck Driver's Concern, Transportation Industry Consultants, Inc., sound on slide

Safety Attitudes, Industrial Training Aids, film, color, 10 minutes

The Professional Driver, Transportation Industry Consultants, Inc., sound on slide

Unit 5.1

A New Way to Lift, National Safety Council, film color, 10 minutes

Be a Pro, Hyster Co., (forklift operation), film, 16 mm, color, 17 minutes

Bend Your Knees, International Loss Control Institute, film, 16 mm, color, 22 minutes

Unit 5.1 (continued)

Delivery Injuries, The Film Library, film, color, 7 minutes

Don't Drop the Ball, The Film Library, (forklift operation), film 16 mm, color, 18 minutes

Driver's Pocket Guide to Hazardous Materials, J.J. Keller and Associates, A simplified version of the D.O.T. Hazardous Materials Regulations, including colored placard charts, 267 pages

Handbook of Rigging - Third Edition - by W.E. Rossnagel, McGraw-Hill Publishing, An in-depth text covering rope, chain, cables, wire ropes, slings, blocking, bracing and useful formulas, 383 pages

Handle With Care, Eaton Corp., (forklift operation), film, 16 mm, color, 16 minutes

High Pressure Cylinders, International Training Consultants, (safe handling), 35 mm filmstrip, with cassette

How to Avoid Muscle Strains, National Safety Council, film, 16 mm, color, 15 minutes

Injury Control, American Trucking Associations, 7 different slide cassette programs explaining safe work practices

Lifting, Man's Age Old Problem, National Safety Council, film, color, 14 minutes

Manual Lifting, International Training Consultants, 35 mm filmstrip and cassette

Rythm ("Remember How You Treat Hazardous Materials"), Du Pont, program, seminars, slides, cassettes, films, filmstrips, cards, posters, decals

Safe Operation of Industrial Trucks, National Fire Protection Association, wall chart

Techniques of Lifting, National Safety Council, film, color, 10 minutes

The Big Lift, Hyster Co., (forklift operation), film, color, 15 minutes

The Color of Danger, National Safety Council, (forklift operation), film, color, 25 minutes

The Industrial Weight Lifter, National Safety Council, (avoiding back injuries), film, 16 mm, color, 15 minutes

The Split Second, Industrial Training Aids, (preventing industrial accidents), film, color, 11 minutes

Transportation Emergency Guides, Manufacturing Chemists Association, (information cards with accidents involving chemicals)

Unit 5.1 (continued)

NOTE: Many of these items on safe lifting are also applicable to Unit 5.5

Unit 5.2

Handling Hazardous Materials, American Trucking Associations, covers all aspects of handling hazardous materials, duties of transport personnel and illustrates placards and labels with instructions for their use

Hazardous Materials Slide Program, American Trucking Associations, a 5 part audio-visual presentation for training drivers

Hazardous Materials Supplies, American Trucking Associations or J.J. Keller and Associates, can supply vehicle placards, shipping labels, cargo manifests and wall chart-loading and storage guides

Motor Carrier Employees Handbook for the Prevention of Freight Loss and Damages, American Trucking Associations, training material for transportation personnel who handle freight or freight documents to prevent damages, loss or delays

Transportating Hazardous Waste, American Trucking Associations, covers E.P.A. and D.O.T. as well as State requirements for hazardous waste transportation including the cargo manifest, registration and permit requirements

Unit 5.3

Driver's Duty Status Record Supplies, American Trucking Associations, or J.J. Keller and Associates can supply Driver's Daily Status Record Books (formerly called log books), multi-day logs, monthly log summary sheets and log summary envelopes

Driver's Log, Transportation Industry Consultants, Inc., sound on slide

Supervisors Guide to Hours of Service, J.J. Keller and Associates, a comprehensive training booklet of 49 pages, covering both Federal and State drivers hours of service regulations. Provides examples, charts and covers use of the various type logs as required by the Driver's Duty Status Record

Unit 5.4

A Life at Stake - CPR, Greater Los Angeles Chapter - National Safety Council, 16 mm film or video cassette on Cardiopulmonary Resuscitation, 21 minutes

Be Your Own Traffic Judge, National Safety Council, (evaluating accidents), booklet, film, slides

Unit 5.4 (continued)

Bleeding--What to Do, The Film Library, film, 16 mm, color, 17 minutes

Breath of Life, National Safety Council, (mouth to mouth resuscitation), film, 16 mm, color, 20 minutes

Cardiopulmonary Resuscitation (CPR), US Department of the Interior, film, color, 19 minutes

Emergency First Aid, Film Communicators, film, 16 mm, color/sound, 19 minutes; slides, color, 35 mm, 19 minutes; filmstrip, 35 mm, 19 minutes

Extinguish That Fire, The Film Library, film, 16 mm, color, 25 minutes

Facts for Drivers, American Trucking Associations, 133 pgs (also under Section 2 and Section 3)

Fire Prevention and Fire Fighting, Transportation Industry Consultants, Inc., sound on slide

First Aid Action, The Film Library, film, 16 mm, color, 22 minutes

First Aid Now, National Safety Council, film, 16 mm, color, 26 minutes

First On the Scene, Greater Los Angeles Chapter - National Safety Council, a 16 mm film detailing steps to take at the scene of an accident, 16 minutes

Flammable Liquid Fire Safety, The Film Library, film, color, 20 minutes

In Case of Accident, National Safety Council, film, B&W, 10 minutes

Incident Rendered Safe, Greater Los Angeles Chapter - National Safety Council, a 16 mm film dealing with 2 road accidents involving hazardous chemical loads, 22 minutes

Incident Rendered Safe, The Film Library, (hazardous cargo accidents), film, color, 20 minutes

Portable Fire Extinguishers, The Film Library, film, 16 mm, color, 20 minutes

Preventable--Yes or No, The Film Library, film, color, 10 minutes

Red Cross Multimedia Course in First Aid, See local chapters of American Red Cross

Report That Accident, National Safety Council, film, 16 mm, color, 10 minutes

Unit 5.4 (continued)

Standard First Aid Film Series, National Safety Council, 10 films

1. The Why and How of Standard First Aid
2. First Aid Artificial Respiration
3. First Aid Bandaging
4. First Aid for Burns
5. First Aid for Common Emergencies
6. First Aid for Injuries to Bones, Joints and Muscles
7. First Aid for Poisoning
8. First Aid for Shock
9. First Aid Transportation of the Sick and Injured
10. First Aid for Wounds

Each film is in 16 mm, B & W, 25 minutes long

The Chemistry of a Petroleum Fire, The Film Library, film, 16 mm, color, 28 minutes

Using Fire Extinguishers, National Fire Protection Association, film, 16 mm, color, 13 minutes

Unit 5.5

A Question of Attitude, Greater Los Angeles Chapter - National Safety Council, 16 mm film dealing with the role of emotions and personal problems in accidents, film, color, 10 minutes

Alcohol, Tobacco and Drugs Versus Physical Fitness, Greater Los Angeles Chapter - National Safety Council, 16 mm film or video cassette, 23 minutes

Driver Attitudes, Greater Los Angeles Chapter - National Safety Council, 16 mm film or video cassette covering drinking and driving and attitudes/emotions with some stop-action multiple choice questions (question sheet included), 15 minutes

Drugs, Drinking and Driving, AIMS Instruction Media Series, Inc., film, 16 mm, color, sound, 20 minutes

Fatigue Can Be Fatal, National Safety Council, 8 pages

Fit to Drive. The Film Library, (physical fitness and medication), film, color, 10 minutes

Liquor, Narcotics and You, Transportation Industry Consultants, Inc., sound on slide

Unit 5.5 (continued)

Marijuana, Driving and You, Greater Los Angeles Chapter - National Safety Council, 16 mm film on effects of marijuana on driving abilities, 13 minutes

Moods in Safety, Industrial Training Aids, film, color, 21 minutes

Safety Belts--Fact or Fiction, National Audio Visual Center, 50 35 mm slides, sound tape and script, 12 minutes

Safety Through Seat Belts, Industrial Training Aids, film, B&W, 12 minutes

The Driving Edge, Greater Los Angeles Chapter - National Safety Council, (physical fitness and driving), 16 mm film, 10 minutes

Truck Drivers Only, Greater Los Angeles Chapter - National Safety Council, 16 mm film, color, showing professional driver's need for good on-the-road living habits, 14 minutes

UFO/Unrestrained Flying Objects, (safety belts), General Motors, Corporation, California Traffic Safety Foundation, film, 16 mm, color, 14 minutes

Where Have All the People Gone? (safety belts), California Traffic Safety Foundation, film, 16 mm, color, 14 minutes

NOTE: Many of the items listed in Unit 5.1 Re: Lifting may be used here

Unit 5.6

Bulletin Advisory Service, State Laws Department of American Trucking Associations (same address as Safety and Security Department) order number SL 1011, gives complete State requirements concerning taxes, sizes and weights, special permits, registration, operating authority, vehicle requirements, and summary tables and charts, available by annual subscription

Federal Regulations for Private Truck Operators, Private Truck Council of America, interprets the laws in easy to understand language, revised periodically

Rand McNally Motor Carriers' Road Atlas, Rand McNally & Company, 52 pgs

State Regulations for Private Truck Operators, Private Truck Council of America, gives concise explanation on various State laws affecting the private carrier, revised periodically

Unit 5.6 (continued)

Summary of Size and Weight Limits, State Laws Department of American Trucking Associations (same address as Safety and Security Department) order number SL 0040, a State by State summary in table form of size and weight limits

Truckers Atlas for Professional Drivers, Creative Sales Corporation, 376 pgs

1984 Trucker's Almanac, J.J. Keller and Associates, covers 21 sections dealing with State size and weight regulations, reciprocity, proration, ports of entry, exempt commodity hauling, rest areas and low underpasses

Unit

American Roadmasters, American Trucking Associations, 16 mm color film, helps drivers to understand how to present a better public image while driving safely and economically, 28 minutes

DOT Audit Guide, Private Truck Council of America, explains how to audit your own fleet operation for compliance with the Federal Motor Carrier Safety Regulations, illustrates record forms needed for compliance, which may be duplicated

Five to Drive By, National Safety Council, (professionalism in driving), slide show, 30 slides and script book

Five Points of Pride, Greater Los Angeles Chapter - National Safety Council, 16 mm film covering 5 basics that all good pro drivers follow: driving with skill; obeying the law; driving economically; being on time and keeping good will; 10 minutes

How and Where to Check Driving Records, American Trucking Associations and J.J. Keller and Associates can supply manuals giving all information necessary to check a driver's past driving record on a State-by-State basis

Just One Road, American Trucking Associations, 16 mm color film helps motorist and professional drivers understand one another better, 14 minutes

More Than Maneuvers, National Safety Council, (courtesy in driving), film, 16 mm, color, 10 minutes

Personnel Record Forms, American Trucking Associations or J.J. Keller and Associates can supply applications for employment, D.O.T. Physical Examination forms, certificates of road test and written examinations, annual review of violations record forms and complete driver qualification kits

Unit 5.7 (continued)

Sharing the Road, American Trucking Associations, 16 mm color film, designed to motivate professional drivers regarding sharing roads with the public, 16 minutes

SOURCES

AC Spark Plugs Division
General Motors Corporation
Flint, MI 48556

AIMS Instructional Media Services
6262 Justin Avenue
Glendale, CA 91201

Aetna Life & Casualty Company
151 Farmington Avenue
Hartford, CN 06156

American Automobile Association
8111 Gatehouse Road
Falls Church, VA 22042

American Bosch
3664 Main Street
Springfield, MA 01107

American Trucking Associations, Inc.
ATT: Safety and Security Department
1616 P Street, NW
Washington, DC 20036

Auto Club of Southern California
Terminal Annex, Box 2890
Los Angeles, CA 90051

Bendix Corporation
Heavy Vehicle System Group
Elyria, OH 44035

Bumpa-Tel, Inc.
P.O. Drawer A
Cape Girardeau, Missouri 63701

Bureau of Motor Carrier Safety
ATT: Regulations Division
400 Seventh Street, NW
Washington, D.C. 20950
(202) 426-1700

CAV Sims Bryce
Joseph Lucas No. America Inc.
30 VanNostrand Avenue
Englewood, NJ 07631

Channing L. Bete, Co., Inc.
45 Federal Street
Greenfield, MA 01301

California Traffic Safety Foundation
4111 Broadway
Oakland, CA 94611

Clark Equipment Company
1300 Falahee Road
Jackson, MI 49203

Creative Sales Corporation
762 West Algonquin Road
Arlington Heights, IL 60005

Cummins Engine Company, Inc.
1000 Fifth Street
Columbus, IN 47201

Direct Safety Company
7815 South 46th Street
Phoenix, Arizona 85040

E.I. Dupont de Nemours & Co., Inc.
Applied Technology Division
Wilmington, DE 19898

Eaton Corporation
North American Headquarters
Transmission Division
Kalamazoo, MI 49003

Film Communicators
11136 Weddington Street
North Hollywood, CA 91601

The Film Library
International Safety Academy
PO Box 76146
Los Angeles, CA 90076

Ford Motor Company Film Library
The American Road
Dearborn, MI 48121

General Motors Corporation
Public Relations Staff
Film Library
General Motors Building
Detroit, MI 48202

Greater Chicago Safety Council, Inc.
10 North Clark Street
Chicago, IL 60602

Greater Los Angeles Chapter of the
National Safety Council
616 South Westmoreland Avenue
Los Angeles, California 90005

The Hartford Insurance Company
Hartford Plaza
Hartford, CT 06115

Hyster Company
Industrial Truck Operations
PO Box 847
Danville, IL 61832

Hyster Company (for catalog)
Marketing Training Department
PO Box 2902
Portland, OR 97208

Indiana University
Audio-Visual Center
Bloomington, IN 47401

Industrial Training Aids
Box 326
Naperville, IL 60540

Institute of Driver Behavior
PO Box 165
Grosse Ile, MI 48138

International Loss Control Institute
PO Box 1997
Atlanta, GA 30301

International Training Consultants
99 East Magnolia Blvd, Suite 113
Burbank, CA 91502

Intext, Inc.
Driver Testing Equipment Division
925 Oak Street
Scranton, PA 18515

International Safety Academy
10575 Katy Freeway
PO Box 19600
Houston, TX 77024

International Safety Academy
The Film Library
PO Box 76146
Los Angeles, CA 90076

J. J. Keller & Associates, Inc.
145 West Wisconsin Avenue
Neenah, WI 54956

Library Filmstrip Center
3033 Aloma
Wichita, KA 67211

Liberty Mutual Insurance Company
Loss Prevention Department
175 Berkeley Street
Boston, MA 02117

J. Willard Lord Publishing Company
1007 Travers Drive
Charlestown, South Carolina 29412

Mack Trucks, Inc.
Box M, 2100 Mack Boulevard
Allentown, PA 18103

Manufacturing Chemists Association
1825 Connecticut Avenue, NW
Washington, DC 20009

McGraw-Hill Publishing, Inc.
ATT: Mail Order Book Dept.
1221 Avenue of the Americas
New York, New York 10020

National Audiovisual Center
General Services Administration
ATTN: Order Section, NACDO
Washington, DC 20409

National Fire Protection Association
470 Atlantic Avenue
Boston, MA 02210

National Safety Council (NSC)
444 N. Michigan Avenue
Chicago, IL 60611

New York State College Film Library
Roberts Hall
Cornell University
Ithaca, NY 14850

North American Van Lines
Director of Training
PO Box 988
Fort Wayne, Indiana 46801

Prestolite Company
Technical Service Department
511 Hamilton Street
Toledo, OH 43602

Private Truck Council of America, Inc.
2022 P Street, NW
Washington, DC 20036

Rand McNally & Company
PO Box 7600
Chicago IL 60680

Roto-Master
Advertising Department F-0
7101 Fair Avenue
North Hollywood, CA 91605

Shell Oil Company
Public Affairs Department
PO Box 2463
Houston, TX 77001

Standard Motor Products
Marketing Services Department
37-18 Northern Boulevard
Long Island City, NY 11101

Transportation Industry
Consultants, Inc.
201 Office Park Drive
Birmingham, AL 35223

U.S. Department of the Interior
Mine Enforcement and Safety Admin.
4800 Forbes Avenue
Pittsburgh, PA 15213

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

Notes:

U.S. Department
of Transportation

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pecial Programs
Administration

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federal regulations
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federal regulations

CODE OF FEDERAL REGULATIONS

(REVISED AS OF NOVEMBER 1, 1983)

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INFORMATION CONCERNING THE REGULATIONS

The Department of Transportation, like all Federal agencies, publishes its new regulations and amendments to its existing regulations in a publication called the Federal Register. The Federal Register is published Monday through Friday by the Office of the Federal Register, an agency of the General Services Administration. It contains not only final rules but also executive orders of the President, proposed rules, legal and informational notices, and other Federal agency documents of public interest. The Federal Register is generally sold on a semi-annual and annual mail subscription basis. Copies of individual issues are also available. Information regarding Federal Register subscriptions and individual issues can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 or call (202) 783-3238.

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FTS 229-1056
COM (205) 254-1056

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ARCO Plaza, C-Level
505 South Flower Street
Los Angeles, CA 90071
FTS 798-5841
COM (213) 688-5841

CALIFORNIA
Room 1023, Fed. Bldg.
450 Golden Gate Avenue
San Francisco, CA 94102
FTS 556-6657
COM (415) 556-0643

COLORADO
Room 117, Fed. Bldg.
1961 Stout Street
Denver, CO 80294
FTS 327-3964
COM (303) 837-3964

COLORADO
World Savings Building
720 North Main Street
Pueblo, CO 81003
FTS 323-9371
COM (303) 544-3142

FLORIDA
Room 158, Fed. Bldg.
400 West Bay Street
Jacksonville, FL 32202
FTS 946-3801
COM (904) 791-3801

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Room 100, Fed. Bldg.
275 Peachtree Street, NE
Atlanta, GA 30303
FTS 242-6948
COM (404) 221-6947

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Room 1365, Fed. Bldg.
219 S. Dearborn Street
Chicago, IL 60604
FTS 353-5133
COM (312) 353-5133

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Sudbury Street
Boston, MA 02203
FTS 223-6071
COM (617) 223-6071

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GLOSSARY AND
LIST OF ABBREVIATIONS

GLOSSARY AND LIST OF ABBREVIATIONS

abandon To give up. For example, when consignee or shipper relinquishes or gives up damaged freight to carrier.

A.C. generator An electrical generator that generates voltage and current by rotating a magnetic field across stationary conductors. Also called alternator, it produces alternating current and uses diodes to change the alternating current to direct current. See **D.C. generator**.

accelerate To increase speed.

accelerator pedal Depresses accelerator to increase engine speed.

acceptance Receipt by the consignee of a shipment. This terminates the common carrier contract for transportation.

accessorial service A service rendered by a carrier in addition to a transportation service, such as stopping in transit to complete loading or to partially unload. Also heating, storage, etc.

adapter, electrical A device that allows a connection to be made between two items of equipment having different types of connectors Most often used to connect electrical lines, particularly a connection between the tractor and trailer, when one electrical line has four prongs and the other six prongs.

adjustable axles See **sliding tandem.**

agency Used interchangeably with call station but generally an agent picks up and delivers freight for an intercity carrier while a call station handles orders from shippers but performs no freight handling functions. See **call station.**

agent A person authorized to transact business for and in the name of another. A driver becomes an agent of the trucking company when signing for freight.

aggregated shipments Several shipments from different shipper to one consignee that are consolidated and treated as a single consignment.

agitator body Truck body designed and equipped to mix concrete in transit.

agreed valuation Freight value mutually agreed upon by shipper and carrier as a basis for transportation charges. It also may represent an agreed maximum amount that can be recovered in case loss or damage.

agreed weight A weight set and agreed upon by carrier and shipper as a basis for charges.

air brakes Brakes that utilize compressed air instead of fluid.

air cleaner Device for cleaning and purifying air entering engine. Also called **air filter.** There may be two, a primary a secondary.

air compressor Device to build up and maintain required air pressure in the brake system reservoir.

air filter Same as **air cleaner.**

air filter restriction gauge Registers the flow of air through the air filter element. Provides indication of filter's obstruction by dirt and other materials which would restrict the flow of air to the engine.

air hose See **air lines.**

air intake distributing manifold Distributes air to the various cylinders of the engine and attaches to the cylinder heads at the intake ports.

air-lift axle An axle with an elevating device operated by air that enables the driver to regulate the amount of weight carried on that axle by raising or lowering it.

air lines Used to carry compressed air from one part of the air brake system to another and from tractor to the trailer. One line is called the **emergency** or **supply** line and is always charged with compressed air. The other line is called the **service** or **control** line. When the air brake treadle valve is depressed, air flows from the supply resevoir through the **service** line and causes the brakes to apply.

air-over-hydraulic brakes Brakes on a vehicle that have a regular hydraulic system assisted by air pressure.

air pressure gauge Measures pressure of air in air tanks in psi. If the pressure drops below 60 psi, a low pressure warning device (buzzer or light) will operate, indicating unsafe vehicle. Sometimes there are two. The second gauge indicates pressure used during braking.

air reservoir Storage tank for compressed air.

air reservoir (trailer) Storage tank for compressed air for the trailer brakes.

air slider A cab-controlled sliding fifth wheel that can be unlocked by air to be moved backward or forward. See **sliding fifth wheel**.

air tag A tag axle that has two bellows-like air bags that, when filled, force the tractor's rear axle harder against the ground for a smoother ride and for weight distribution between the two axles of the tractor.

allowance (1) A sum granted as a reimbursement or repayment. (2) A deduction from the gross weight or value of goods.

alternating current Electrical current that changes its direction of flow many times a second and is used in a building, as opposed to **direct current** as used on a vehicle.

American Trucking Associations, Inc. (ATA) A national federation of independent and automomous state trucking associations, each representing all classes and types of truck operation, and thirteen independent and automomous conferences, each of which represents a special class or type of truck operation. Headquarters location 1616 P Street, N.W., Washington, DC 20036.

ammeter An instrument that measures the amount of current flowing in an electrical current.

ampere Unit of measurement of flow of electrical current.

application pressure air gauge Gauge that indicates pressure being applied by brakes during brake operation. See **air pressure gauge**.

A.P.U. Authorized pickup.

arrival notice A notice, furnished to consignee, of the arrival of freight.

articulated Having parts connected by joints. A tractor-trailer is an articulated vehicle.

assign The transfer of property to another, frequently for the benefit of creditors.

assignee One to whom a right or property is transferred.

assignor One by whom a right or property is transferred to another.

astray freight Freight bearing marks indicating origin and destination, but separated from the waybill. See **over freight**.

automobile transporter body Truck or trailer body designed for the transportation of vehicles.

auxiliary transmission A second transmission connected with the main transmission to provide a wider range of speeds and gear ratios.

axle The bar that connects opposite wheels. There are two types of axles: live axles, which transmit power from the drive shaft to the wheels, and dead axles, which do not transmit power and are used only to help carry the load or to steer.

axle ratio Ratio of axle to drive line; the number of turns of the drive line in relation to one full turn of the drive wheels. The higher the numerical ratio, the slower the road speed. See **gear ratio.**

axle temperature gauges Indicate temperature of lubricant in drive axles.

axle weight The amount of a rig's gross weight that rest on any one axle.

back haul (1) The return part of the trip; (2) the freight that is carried on the return portion of a trip; (3) a shipment that is carried back over part of a route that has been previously traveled.

balloon freight Light, bulky cargo.

band ply The first ply on the inside of a tire.

base state The state in which a vehicle is primarily registered.

battery An electrochemical device for storing and supplying electrical energy.

BBC The length of the tractor from the bumper to the back of the cab. Always stated in inches.

bead The inner edge of the outer wall of a rubber tire, fitting on the rim. The "foundation" of a tire. It is made of high tensile steel wires and wrapped and reinforced by the plies.

bead-to-bead measurement The distance from the heel of one bead straight up at 90° to the bead over the crown and down the other side to a position on the heel of the other bead directly opposite the starting point.

belt drive axle An axle driven by V-belts, which transmit power from the drive axle. See **V-belt drive.**

berm The shoulder of the road.

bill of lading (B/L) The written transportation contract between shipper and carrier (or their agents). It identifies the freight, who is to receive it and the place of delivery and gives the terms of the agreement. All goods going to a receiver at one destination in a single shipment or on one truck must be on a single bill of lading.

The straight bill of lading provides that freight be delivered to the receiver shown on the bill. It is non-negotiable. Surrender of this type of bill of lading is not required except when it is necessary for the receiver to identify himself. This might be necessary, for example, for certain bonded goods such as liquor. Always printed on white paper.

The order bill of lading is negotiable. Its purpose is to enable a shipper to collect for the shipment before it reaches its destination. The shipper sends an original bill of lading and a draft for the charges through a bank. The receiver pays the carrier's agent the amount of the draft and then can receive the goods. With this method, the shipper customarily consigns the shipment to himself. The person or company to be notified at destination is specified. The shipment may be released to the receiver only upon the order of the shipper. The order bill of lading must be surrendered with delivery of the freight. Always printed on yellow paper.

Either straight or order bills of lading may be designated as "through." A through bill of lading covers shipment by more than one transportation company at a fixed rate for the entire service. More than one type of transportation company (such as truck and rail) may be utilized. Also see **clean bill of lading.**

bill of sale A contract for the sale of goods.

billed weight The weight shown in a freight bill.

bingo card (Slang) See **cab card.**

birdyback Transportation of highway freight containers on aircraft.

blanket waybill A waybill covering two or more consignments of freight.

blasting agents See **HAZARDOUS MATERIALS.**

bleed the air tanks To drain the accumulated water out of the air tanks of a tractor to prevent the condensed water from reducing air tank capacity and thus cutting braking efficiency.

bleed the fuel lines To remove trapped air from the fuel lines.

blind side Right side of the truck and trailer, opposite of the **sight side.**

blocking Supports used to prevent cargo from shifting during transportation.

blower (1) A device that forces additional air into the engine to increase its efficiency and horsepower. Two types of blowers are the supercharger and the turbocharger; (2) fan that blows air over ice to maintain a low temperature in a trailer transporting perishable goods.

blow-off valve A regulatory valve on the air system that allows the escape of excess air pressure if the governor on the air compressor fails to operate.

blue label See **HAZARDOUS MATERIALS.**

B.M.C.S. See **BUREAU OF MOTOR CARRIER SAFETY.**

bobtail A tractor without a trailer; or a straight truck.

bogey Usually an axle added to tractor to carry more weight as for weight distribution. See **bogies.**

bogies An assembly of two or more axles, such as a tandem axle. See **tandem axle.**

bonded warehouse A warehouse approved by the U.S. Treasury Department and under bond or guarantee for the strict observance of the revenue laws. Also utilized for storing goods until duties are paid or otherwise released.

bonnet The protective covering over the air intake that keeps water or other substances from entering the air system; or the hood on any conventional type tractor.

boomers (Slang) See chain binders.

boom it down (Slang) Tighten chains around freight.

bore The diameter of a cylinder.

bottlers body Truck body designed for hauling cased, bottled beverages.

bottom dump Trailer body designed to dump its cargo through gates in bottom or floor of the trailer.

brake drum The rotating unit of the brake that is attached to the wheel.

brake horsepower The actual horsepower of an engine, measured by a brake attached to the drive shaft and recorded on a dynamometer.

brake lining A material designed to create friction that is attached to the brake shoe.

brake shoe The nonrotating unit of the brake (to which the brake shoe is attached) that contacts the rotating unit to supply braking force.

braking distance See **total stopping distance.**

break bulk To separate a composite load into individual shipments and route them to different destinations.

break bulk point or terminal A place where a composite load is separated into individual shipments and routed to different destinations.

break the unit (Slang) Uncouple the tractor from the trailer.

bridge The distance between one axle and another, or between two sets of axles. Used in some states to ascertain the permissible gross weight for the vehicle. Also called **spread.** See **spread tandem.**

B-trains A combination consisting of a tractor and two semi-trailers, the second trailer coupled to the first trailer by use of a fifth wheel, which is mounted directly behind the cargo body on the lead semi-trailer.

bulk freight Freight not in packages or containers.

bulkhead A metal or wooden device located on the back of the tractor or on the front of the trailer to keep loads from sliding forward and going through cab of tractor. Sometimes called a **header board.**

burdened vehicle In any situation, the vehicle which is required by law to yield right-of-way to another, "privileged" vehicle. See **privileged vehicle.**

Bureau of Motor Carrier Safety (BMCS) A part of the Federal Highway Administration, which is one of several administrations within the U.S. Department of Transportation that issues the Motor Carrier Safety Regulations (FMCSRs).

bushing A cylindrical metal sleeve inserted into a machine part for reducing the effect of friction on moving parts or for decreasing the diameter of a hole.

buttress The area on a tire between the edge of the tread and the sidewall.

cab-alongside-engine A tractor in which the cab is located alongside the engine (abbreviated CAE). Same as **cab-beside-engine.**

cab-behind-engine A tractor on which the cab is located behind the engine; a **conventional cab.**

cab-beside-engine Same as **cab-alongside-engine** (abbreviated CBE).

cab card Uniform Identification Cab Card in which the various State operating authorities and permit stamps are affixed. Called **bingo card** by drivers.

cab, conventional A tractor on which the cab is behind the engine. Also see **snub-nose.**

cab-over-engine A tractor on which the cab is located over the engine (abbreviated COE).

call station A person or company that agrees to transact business for a trucking company in a given location, generally a location where terminal facilities are not justified. Call station handles calls from shippers but usually performs no freight handling function. See **agency.**

camber Outward (or inward) tilt of wheels from true vertical.

camel back body Truck body with floor curving downward at the rear.

carbon monoxide (CO) A colorless, odorless, highly poisonous gas, produced by the incomplete combustion of fuel. It is usually expelled by the exhaust system.

carburetor That part of the gas engine fuel system where gasoline and air are mixed in controlled proportions.

cargo The freight carried by a vehicle.

cargo manifest See **manifest.**

carrier See **motor carrier.**

carrier's lien Right of a motor carrier to retain property which it has transported as security for the collection of freight charges.

cartage The charge made for hauling freight.

cartage allowance See **allowance.**

casing The tire structure, excepting tread and sidewall rubber.

cast wheel A casting that includes the hub and spokes at the end of which are studs, clamps and nuts that are used to support the rim.

caster Forward (or rearward) inclination of kingpin or support arm of wheel; amount of tilt in axle beam.

center of gravity The point within the length and width of a vehicle around which its weight is evenly distributed or balanced.

centrifugal force The force tending to pull a thing outward it is rotating rapidly around a center or rapidly rounding a curve.

certificate of weight An authoritative statement of the weight of a shipment prepared by a weighmaster.

Certificate of Public Convenience and Necessity Authority or certificate granted by the Interstate Commerce Commission to common carriers by railroad, motor vehicle, and water to operate in interstate commerce.

cetane number Rating applied to ignition properties of diesel fuel; the higher the number, the better the ignition quality. See **octane number.**

chain binders A device used to remove slack from chains used to tie down loads.

charge it (Slang) Allow compressed air to flow into semi-trailer lines.

charges (payment of transportation charges) Ordinarily, unless specific arrangements have been made, no carrier is permitted to deliver or relinquish possession at destination of any freight transported by it until all tariff rates and charges thereon have been paid. Carriers upon taking precaution deemed to be sufficient to assure payment of tariff charges may relinquish possession of freight in advance of payment of tariff charges and may extend credit in the amount of such charges for a period of seven days.

chasing Steering a tractor while backing so as to cause the tractor to follow (i.e., "chase") along the path of the trailer. Combines with "jacking" to allow the trailer to be maneuvered along the prescribed path. See **jacking.**

chassis The part of a motor vehicle that includes the frame, suspension system, wheels, steering mechanism, etc., but not the body and engine.

check valve Device to automatically isolate one part of air brake system from another. A one-way check valve provides free air flow in one direction only. A two-way check valve permits actuation of the brake system by either of two brake application valves

circuit breaker A device that automatically interrupts the flow of an electric current when the current becomes excessive.

circuit (electrical) A path through which electrical current can flow. A closed circuit provides a continuous, unbroken path from a current source through various current consuming devices back to the source (or a common ground). An open circuit occurs when the current path is interrupted or broken either by an open switch or relay or by a broken wire or loose connection. A short circuit occurs when a damaged or loose wire accidently touches another damaged wire or some other conductive material. Current then takes a "short cut" to ground, bypassing part of its normal path. See **grounded circuit.**

circuitous route An indirect route.

claim (1) A demand for payment to compensate for freight damage that is supposed to have occurred while the cargo was in the hands of the carrier; (2) A demand for refund of an overcharge. See **overcharge.**

claim agent An employee who adjusts or settles claims made against his company.

claim tracer A request for information concerning the status of a claim.

claimant Person or company filing a claim.

classification (freight) A publication containing a list of articles and the classes to which they are assigned for the purpose of applying class rates together with governing rules and regulations.

classification rating The class to which an article of freight is assigned for the purpose of applying class rates.

Class I Motor Carriers Carriers having average gross operating revenues (including interstate and intrastate) of $5 million or more per year.

Class II Motor Carriers Carriers having average gross operating revenues (including interstate and intrastate) between $1 to $5 million per year.

Class III Motor Carriers Carriers having average annual gross operating revenues (including interstate and intrastate) of less than $1 million per year.

clean bill of lading A bill of lading signed by the carrier for receipt of merchandise in good condition (no damage, loss, etc., apparent), and which does not bear such notation as "shipper's load and count."

clean bore tank A single tank without compartments inside.

clear record A record which shows that a shipment was handled without loss or damage.

clearance lights The small lights that outline a vehicle's length and breadth. The lamps at the front and sides are amber; those visible from the rear are red. Also called marker or running lights. Also see **identification lights.** Required by the F.M.C.S.R. on vehicles 80 inches or more in width.

clearing house An organization set up to process and collect bills for participating trucking companies.

cleat A strip of wood or metal used for additional strength; to prevent warping; or to hold something in position.

clutch The part of the power train that allows the driver to connect the engine to the wheels.

C.O.D. See **collect shipment.**

collect shipment A shipment where collection of freight charges and advances are made by the delivering carrier upon delivery. Abbreviated as COD and commonly called COD by truckers.

combination rate A freight rate made through rates by combining two or more rates published in different tariffs.

combination through rate A through rate made by combining two or more rates published in different tariffs.

combination vehicle A truck or truck-tractor coupled to one or more trailers, also referred to as a "rig." See **rig.**

combustible Able to catch fire and burn easily.

combustible liquids See **HAZARDOUS MATERIALS.**

combustion Burning.

commodity Any article of commerce. Goods shipped.

commodity, exempt One that may be transported in interstate commerce without operating authority or published rates.

common carrier A transportation business that offers service to the general public. Interstate common carriers must hold a franchise issued by the Interstate Commerce Commission. This franchise limits service to a specific geographical area. Rates also are regulated. Routes and schedules of regular common carriers are regulated by government agencies, but irregular route common carriers may set their own without regulatory approval. Most states also regulate common carriers.

compression ratio Volume of air above the piston at bottom dead center compared with volume of air at top dead center.

compression stroke A phase of the four-stroke cycle when the air-fuel mix is compressed.

compressor See **air compressor.**

concealed damage A damage to the contents of a package which is apparently in good condition externally.

concealed loss Loss or damage that cannot be determined until the package is opened.

condenser An element usually found in the distributor (in gasoline engine ignition systems) that stores electricity for a short period of time.

connecting carrier Motor carriers which interchange trailers with another for completion of shipments.

connecting rod Rod that connects the piston to the crankshaft.

consign To send or address goods to another.

consignee One to whom something is shipped.

consignee marks A symbol placed on packages for export, consisting of such things as a square, triangle, diamond circle, cross, etc. with designed letters and/or numbers for the purpose of identification.

consignment A shipment.

consignor The person by whom articles are shipped (also known as the shipper).

container Anything in which articles are packed.

container (van body type) A truck or trailer body provided with means for ready removal from and attachment to a vehicle.

containerization Shipping system based upon large cargo-carrying containers that easily can be interchanged between trucks, trains and ships without rehandling the contents.

continuous seal A term denoting that the seals on a truck remained intact during the movement of the truck from origin to destination; or, if broken in transit, that it was done by proper authority and without opportunity for loss to occur before new seals were applied.

contraband Illegal or prohibited traffic or freight.

contract carrier A company that engages in for-hire transportation of property under individual contract or agreement with one or a limited number of shippers.

control (air line) See **air lines.**

converter gear or dolly The coupling device composed of one or two axles and a fifth wheel by which a semi-trailer can be coupled to the rear of a tractor-trailer combination, forming a double-bottom rig.

convertible A truck or trailer that can be used either as a flat-bed or open top by means of removable side panels.

convex mirror A type of mirror having a convex shape in order to show a larger field of view than can be obtained from a flat mirror of the same size.

cords, tire Strands forming the plies in a tire.

core On a radiator, a tubular fin structure acting as a heat exchanger for engine cooling fluids.

corrosive material See **HAZARDOUS MATERIALS.**

cowl Metal structure supporting dash and windshield.

crankshaft A shaft within the engine having one or more cranks for transmitting motion; the connecting rods transmit motion between the pistons and the crankshaft.

creeper gear (Slang) Lowest gear or combination of gears used for extra power.

cubic capacity The carrying capacity of a truck measured in cubic feet.

cubic foot A common measure of the capacity of a truck, 1,728 cubic inches.

curb weight The weight of an empty tractor-trailer minus driver and cargo but including fuel, oil, and all standard equipment.

current regulator A device that controls the amperage output of a generator.

custom house The government office where duties, tolls, import, or export taxes are paid.

cutout relay A magnetic switch used to open and close the electric circuit between the battery and the generator.

cylinder A chamber in the engine block that contains a piston.

Dangerous Articles See definitions under **HAZARDOUS MATERIALS.**

Dangerous Goods See definitions under **HAZARDOUS MATERIALS.**

D.C. Generator An electrical generator that generates voltage by rotating a conductor across a stationary magnetic field. Producing alternating current like an A.C. Generator, the D.C. Generator uses a mechanical device called a commutator, to convert the alternating current to direct current. See **A.C. generator**.

dead axle An unpowered axle used to increase the legal weight capacity of a vehicle.

dead-heading Running empty, without cargo.

defensive driving Driving in a way that avoids conflicts that may be caused by the mistakes of others while making no mistakes yourself.

delivering carrier The transportation company that delivers a shipment.

delivery The act of transferring possession of a shipment. This could be from consignor to carrier, one carrier to another or carrier to consignee.

demurrage Detention of a freight vehicle or container beyond a stipulated time. Also the payment made for such delay.

density The weight of an article per cubic foot. The ratio of mass to bulk or volume.

Department of Transportation (DOT) The federal agency responsible for the administration of the Federal Motor Carrier Safety Regulations. See **Bureau of Motor Carrier Safety**.

depth perception The ability to judge distances.

destination The place to which a shipment is to be delivered.

detention See **demurrage**.

diesel engine An internal combustion engine that uses compression to raise air temperature to the igniting point, whereas fuel is ignited by a spark in a gasoline engine.

differential The part of the power train that permits one wheel to turn at a different rate of speed from the other, as occurs when going around a turn.

differential lock, interaxle type Used on twin-screw tractors, this valve can be set to lock both rear axles together so that they pull as one for off-the-road operation. Never used for over-the-road operation.

direct current Electrical current that always flows in one direction only and is the type used in automotive equipment.

direct drive Refers to a condition in which the transmission is in a gear having a 1:1 ratio, that is, when the engine crankshaft is turning at the same rate as the vehicle drive shaft. See **overdrive** and **underdrive**.

disc brakes Brakes that function by causing friction pads to press on either side of a disc rotating along with the wheel.

disc wheel A single unit that combines a rim and a wheel.

dispatcher Person in charge of dispatching.

dispatching The scheduling and control of intercity traffic and intracity pickup and delivery.

distributor A device for distributing electric current to the spark plugs of a gasoline enginer so that they fire in the proper order.

diversion A change made in the route of a shipment in transit. See **reconsignment.**

divert To change the route of a shipment in transit. See **reconsignment.**

dock A platform where trucks load and unload.

dock receipt A receipt given for a shipment received or delivered at a pier or dock. Whe delivery of a foreign shipment is completed, the dock receipt is surrendered to the transportation line and a bill of lading is issued.

document Anything printed, written, etc., relied upon to record or prove something.

documentation (1) the supplying of documents; (2) the documents that are supplied.

dolly A small platform mounted on wheels that is used in a warehouse to move objects. Also used in reference to (1) The coupling device composed of one or two axles and a fifth wheel used to convert a semi-trailer to a full trailer so it can be coupled to the rear of a tractor-trailer unit, making the combination into a double-bottom rig; (2) landing gear on a trailer.

D.O.T. HAZARDOUS MATERIALS SHIPPING LABELS See **labels, D.O.T. HAZARDOUS MATERIALS WARNING.**
D.O.T. HAZARDOUS MATERIALS WARNING LABELS See **labels, D.O.T. HAZARDOUS MATERIALS WARNING.**

D.O.T. PLACARDS See **placards, D.O.T. HAZARDOUS MATERIALS WARNING**

double-axle See **tandem axle.**

double-clutching Shifting the gears of a nonsynchronized truck transmission without clashing them, by depressing and releasing the clutch pedal twice.

double drop frame A drop frame trailer with one drop behind the kingpin and one in front of the rear axles. See **drop frame.**

double-reduction rear axle A rear end that reduces the drive line rpm in relation to the rear wheel rpm by means of a double reduction of gears. Used where very slow speed is needed. Two reductions are made in the differential. See **gear ratio.**

double bottoms See **doubles.**

doubles A combination vehicle consisting of a tractor, a semi-trailer and a full trailer, coupled together. Also called **twins, twin trailers** and most often **double bottoms.**

drag line A method of moving freight carts around a carrier's terminal. Refers to a moving cable (the line) that operates either from a suspended position overhead or in a slot in the floor. The line supplies the motive power (drag) to the carts when they are attached to the line.

drain lines In some fuel systems, unburned fuel is returned to the supply tank through the drain lines. Not found on all tractors.

drayage The charge made for carting, draying, or trucking freight.

drive axle An axle that transmits power to the wheels. A drive axle is a powered axle that actively pulls the load.

drive shaft A heavy-duty tube that connects the transmission to the rear end assembly of the tractor.

drive train A series of connected mechanical parts for transmitting motion.

drivers (Slang) The drive wheels of a tractor.

driver's duty status record book See **log book, driver's daily.**

driver's log See **log book, driver's daily.**

dromedary tractor A tractor with a cargo body placed between the fifth wheel and the cab.

drop frame A trailer frame that drops downward to increase cargo capability without increasing the vertical clearance of the vehicle. Consists of two types: single drop and double drop.

drop it on the nose Uncoupling a tractor from a semi-trailer without lowering the landing gear to support the trailer's front engine.

drop the body (Slang) Unhook and drive a tractor away from a parked semi-trailer.

dry freight Freight that does not need to be shipped at a specific temperature to prevent spoilage.

dry tank Part of brake system. Air passes from wet tank to dry tank. Dry tank is the air reservoir from which the air is drawn for operating the brake system.

duals A pair of wheels and tires mounted together on the same side of one axle.

dummy coupler A fitting used to seal the opening in an air brake hose connection (glad hands) when the connection is not in use. Sometimes called a dust cap.

dump body Truck or trailer body of any type which can be tilted to discharge its load.

dunnage The material used to protect or support freight in trucks. The weight of dunnage is shown separately on the bill of lading since it is material used around a cargo to prevent damage. Often it is transported without charge.

dusk The beginning of darkness in the evening.

dust cap See **dummy coupler**.

dust shield Sheet metal shield on brake assembly used to keep debris from brakes.

duty A tax levied by a government on imports and exports.

dynamometer A device for measuring the work output of an engine. See **brake horsepower**.

electrical line adapter See **adapter**.

electrolyte A chemical solution (usually sulfuric and water) that covers the positive and negative plates in the cells of an automotive storage battery, it reacts with the chemicals of the plates to produce voltage and current flow.

elevator (Slang) A hydraulic or electrically powered end gate on a truck or trailer.

embargo To resist or prohibit the acceptance and handling of freight. A formal notice that certain freight will not be accepted.

emergency (air line) See **air lines**.

emergency brake release Will override the spring brake control in the event air pressure is lost. You must hold it while pulling out on the spring brake control. For emergency use only.

emergency stop See **stop and emergency stop.**

emission Refers to gases and other materials vented to the atmosphere by the exhaust system.

encroachment The act of intruding or going beyond the proper limits, such as encroachment on another lane of traffic.

engine water jackets Hollow chambers that surround the cylinders and other parts exposed to high temperatures in the engine. They circulate coolant around engine parts to cool them.

enroute On the way to a destination.

enroute inspection See **inspection.**

entry (customs) A statement of the kinds, quantities, and values of goods imported together with duties due, if any, and declared before a customs officer or other designated officer

environmental Relating to the environment (air, water, land). Air and water pollution are environmental problems.

escape ramp A ramp on a steep downgrade that can be used by a truck driver to stop a runaway truck when brakes have failed. The ramp often has a soft gravel surface and forms a steep upgrade to stop the truck. Sometimes called a runaway truck ramp.

ether Substance used as a starting aid for diesel engines in freezing or subfreezing weather.

etiologic agents See **HAZARDOUS MATERIALS.**

evasive Tending or seeking to evade. Evasive action is action taken to evade or escape from a problem, danger, or hazard.

excess freight Freight in excess of the quantity shown on freight bill.

exchange bill of lading A bill of lading issued in exchange for another bill of lading.

exclusive use of truck A request made by a shipper on the bill of lading for the sole use of a vehicle, i.e., no other freight to be carried.

exempt carrier Trucks hauling certain commodities are exempt from Interstate Commerce Commission economic regulation. By far the largest portion of the exempt carriers transport agricultural commodities or seafood.

exhaust manifold That part of the exhaust system that carries the exhaust gases from the cylinders to the exhaust pipe.

exhaust pipe Pipe connected to muffler through which exhaust gases are released. See **tailpipe** and **stack.**

exhaust ports Connecting passages from the inside to the outside of the cylinder heads.

exhaust stroke Phase of the four-stroke cycle when waste gases are pushed out the exhaust valve.

exhaust valves Open to discharge the burned gases from the combustion chambers.

expandable (trailer) Flat bed trailer which can be expanded beyond its regular length to carry larger shipments.

expediting To accelerate a process. Expedited freight service is usually superior to normal service. Dispatching less than truckload quantities on a single truck for quick delivery is an example of expedited service. Such service frequently necessitates payment of "exclusive use of vehicle" freight charges.

explosives See **HAZARDOUS MATERIALS.**

export To send goods to a foreign country.

external contracting brake A type of brake in which the brake shoes contract against the outside of the brake drum.

eye lead time Term used to describe the distance that a driver is looking ahead on the road. A 12-second eye lead time means that the driver is looking ahead the distance he will travel in 12 seconds' time.

Federal Highway Administration (FHWA) Part of the U.S. Department of Transportation. See **Bureau of Motor Carrier Safety.**

Federal Motor Carrier Safety Regulations (FMCSR) Governs the operation of trucks and buses being operated in interstate or foreign commerce by common, contract and private motor carriers. Among other things, the FMCSR specifies insurance requirements, driver qualifications, driving of motor vehicles, hours of service for drivers, reporting of accidents, inspection and repair of vehicles as well as parts and accessories needed for safe operation.

false billing Describing freight on shipping documents so as to misrepresent the actual contents or weight of shipment.

fifth wheel The coupling device located on the tractor's rear frame that is used to join the front end of the trailer to the tractor. It is a flat, rounded plate with a V-shaped notch in the rear.

first aid The immediate and temporary care given the victim of an accident or sudden illness until the services of medical personnel can be obtained.

fishy-back Transportation of truck trailers or highway freight containers on ships or barges.

fixed charges Carrier costs that do not vary with an increase or decrease in traffic. An accounting classifications.

flammable gas See **HAZARDOUS MATERIALS.**

flammable liquids See **HAZARDOUS MATERIALS.**

flap, tire Used in tube type tires, it is a piece of rubber that separates the tube from the bead seat.

flat bed See **low bed.**

flexi-van Trailers with detachable container bodies that are loaded on specially constructed flat cars equipped with two turntables.

float Flat bed semi-trailer.

F.M.C.S.R. See **Federal Motor Carrier Safety Regulations.**

fog lamps Auxiliary headlights for use during fog and mist.

foot brake valve Valve which the driver depresses with his foot, which controls the amount of air pressure delivered to or released from the brake chambers. Also called a **treadle valve**.

forklift A machine used to move goods loaded on pallets or skids.

forklift truck A self-propelled vehicle for lifting, stacking, etc., heavy objects that may be loaded on pallets or skids; it consists typically of projecting prongs that are slid under the load then raised or lowered.

four-by-four (Slang) 4-speed transmission and 4-speed auxiliary transmission.

frame A metal support for the body, power unit, and running gear; the backbone structure around which the vehicle is assembled. Contains the engine mounts, fuel tank supports, etc.

free on board Delivered (by the seller) aboard the train, ship, truck, etc., at the point of shipment, without charge to the buyer. Usually indicates place where responsibility for expenses and risk for goods is passed from seller to buyer. For example, F.O.B. motor carrier would usually mean that a price quoted for goods would include loading on a truck at the seller's building. This term is not always used precisely, and it is best to qualify it to show exactly what is covered. Abbreviated F.O.B.

free time The time period freight is held before storage charges are applied.

free-astray A shipment miscarried or unloaded at the wrong terminal is billed and forwarded to the correct terminal free of charge because it is astray. Hence the term "free-astray." See **astray freight**.

freight Anything being transported.

freight bill Document for a common carrier shipment, Gives a description of the freight, its weight, amount of charges, the rate for charges, taxes and whether collect or prepaid. If the charges are paid in advance or are to be collected at the origin, it is called a prepaid freight bill. If charges are to be collected at destination, it is called a destination or collect freight bill.

freight charge Payment due for freight transportation.

freight claim A demand upon a carrier for the payment of overcharge or loss or damage sustained.

freight forwarder A company that assembles small shipments from various shippers into larger shipments, usually full truck or car load. Forwarders send these consolidated shipments to a station where they are disassembled and routed to the proper destinations. The stations are called break bulk stations. Forwarders try to make up a full truck or car load shipment to take advantage of the better rate for a full load.

friction The resistance to motion of two moving objects or surfaces that touch.

front brake limiting valve Found only on tractors having brakes on the front axle. Limits amount of braking force applied to the front axle brakes under conditions where locking up the front brake might adversely affect the driver's ability to safely steer the vehicle. Usually controlled by a two-way switch mounted on the dashboard. When in "Dry Road" position, limiting valve is not operating. In "Slippery Road" position, the valve is in full operation (only found on the pre 1975 model tractors).

front haul (1) The front portion of a trip, from start to destination; (2) Freight carried on the front portion of the trip. See **back haul**.

fuel filter Device for cleaning engine fuel.

fuel gauge Registers amount of fuel in fuel tank. One for each tank.

fuel pump Pump that moves a fuel from the fuel tank to the engine.

full capping Application of new rubber to the tread area and some distance down the buttress of a used tire.

full trailer A trailer with both front and rear axles; used as the second trailer in a double-bottom rig or hooked behind a straight truck to form a truck-trailer combination. A semi-trailer can be converted into a full trailer by the use of converter dollies. See **semi-trailer**.

furniture van body Truck body designed for the transportation of household goods; usually a van of drop-frame construction.

fuse A wire or strip of easily melted metal, usually set in a plug, placed in a circuit as a safeguard; if the current becomes too strong, the metal melts, thus breaking the circuit.

fusee A colored burning flare used as a signal to warn other road users.

G.B.L. Government bill of lading.

gasket A thin piece of material installed in a joint to prevent leakage.

gateway A point at which freight moving from one territory to another is interchanged between transportation lines.

gear box temperature gauge Indicates temperature of lubricant in transmission.

gear pump Located at the rear of the fuel pump. Driven by the fuel pump main shaft. Consists of a single set of gears to pick up and deliver fuel throughout the fuel system. From gear pump, fuel flows through the filter screen and to the pressure regulator.

gear ratio The relationship of the number of teeth on or revolutions of one gear to the number of teeth on or revolutions of the gear with which it is engaged.

generator Device that converts mechanical energy to electrical energy by means of electromagnetic induction. Automotive generators use the mechanical force of engine rotation to produce voltage and electrical current. See **A.C. GENERATOR** and **D.C. GENERATOR**.

glad hands Connectors mounted on the front of a trailer for connecting air lines from the tractor.

goods Merchandise.

gooseneck The curved section of a trailer frame that includes the kingpin and the fifth wheel apron.

governor (air) Device to automatically control the air pressure being maintained in the air reservoirs. Keeps air pressure between 90 and 120 psi. Prevents excessive air pressure from building up.

governor (fuel) A system of springs and weights with two functions: maintains sufficient fuel for idling with the throttle control in "Idle" position, and cuts off fuel above maximum rated rpm.

grain body Low side, open-top truck body designed to transport dry flowable commodities.

groove On a tire, the space between adjacent tread ribs.

grounded circuit A circuit in which a damaged wire or other current carrying device accidentally touches the vehicle frame or some metal object connected to the vehicle ground. See **circuit**.

gross combination weight The weight of the tractor, trailer, and cargo (abbreviated GCW).

gross ton 2,240 pounds. More commonly called a long ton.

gross vehicle weight The weight of an empty tractor or trailer (abbreviated GVW).

gross weight (1) The weight of an article together with the weight of its container and the material used in packing; (2) as applied to a truck, the weight of a truck together with weight of its entire contents. See **gross vehicle weight** and **gross combination weight.**

half-cab A tractor having only a half of a cab along the left side of the engine.

half capping Application of new rubber only to the tread area of a used tire. See **full capping.**

hand throttle A manually set throttle in a tractor that is used to maintain a certain engine speed. See **throttle.**

hand valve The valve that controls only the trailer brakes. See **trailer brake.**

hazard A source of danger.

hazardous Involving risk or danger to persons or property.

HAZARDOUS MATERIALS The various substances (materials, chemicals, gases, etc.) which the U.S. Government agencies have determined could cause harm or danger to public health and safety when being transported improperly. There are approximately 24 different DOT transport related, broad types or classifications of hazardous materials all of which have strictly enforceable laws or regulations covering such things as types of containers or packages to be used for shipping, the labeling of the packages and/or the placarding of the vehicles, among other requirements. The hazardous material classifications and an example of each are as follows:

> **blasting agents** Any material designed for blasting that is not easily detonated, such as ammonium nitrate fuel oil mixture.
>
> **combustible liquid** A liquid that can be burned such as furnace oil, also see **Flammable Liquids.**
>
> **corrosive material** A substance which will eat away or "burn" your skin such as battery acid.

Hazardous Materials (Cont'd)

etiologic agent Items which are likely to cause diseases in human beings shipped for laboratory analysis.

explosives, Class A An example is dynamite.

explosives, Class B An example is special fireworks.

explosives, Class C An example is small arms ammunition.

flammable gas Any gas (or vapor) usually kept under pressure and which easily catches fire such as propane gas used for cooking.

flammable liquid A liquid that catches fire very easily such as gasoline. Also see **COMBUSTIBLE LIQUID**.

flammable solid A solid material that catches fire easily such as charcoal.

irritating material A liquid or solid material which when exposed to air or fire gives off dangerous or very irritating fumes such as tear gas used for riot control.

non-flammable gas A gas (or vapor) usually kept under pressure and does not burn such as nitrogen used in trailer refrigerator systems.

organic peroxide A substance which is a strong oxidizing agent and fire hazard commonly used in the bleaching of leather.

oxidizer A substance which gives off oxygen which makes it a fire hazard such as ammonium nitrate which is used as a fertilizer by farms.

poison A Any liquids or gases that are extremely dangerous to human life, an example of which is hydrorganic acid (prussic acid) used in the making of pesticides.

poison B Less dangerous poisons than POISON A but are still dangerous to human health such as arsenic used for pesticides.

radioactive material Any material which gives off atomic radiation such as fuel in nuclear powered electrical generating plants.

ORM (other regulated material) Any substance which poses a human health and safety risk and which does not fit any of the other hazardous materials classes. There are 5 classes of ORM which are:

Hazardous Materials (Cont'd)

ORM-A Any material which can cause an uncomfortable reaction in human beings exposed to it such as chloroform.

ORM-B Any substance which can cause damage to the transport vehicle if leaked during transport such as mercury.

ORM-C Any substance which does not fit the ORM-A or ORM-B classification but which makes it unfit for transportation unless properly prepared such as bleaching powder.

ORM-D Any material packaged in small quantity for consumer use that would otherwise be subject to the hazardous material classifications, but due to the fact it is packaged in small quantities poses a minimum risk, such as small cans of cigarette lighter fluid.

ORM-E Any substance which is not included in any of these other hazardous materials classes but which is subject to the Hazardous Materials Regulations such as some forms of Hazardous Waste. Example - sludge from manufacturing procedures and Hazardous Substances such as materials used to eliminate fungus.

spontaneously combustible material (solid) Any solid substances which, when exposed to air may increase in temperature and/or catch fire, such as wet hay.

water reactive material (solid) Any solid material (including sludges or pastes) which when accidently gotten wet may catch fire and/or give off unhealthy gases such as magnesium metal used in making car engines.

waste, hazardous Materials that are hazardous which are being shipped to a disposal site or dump, and which requires special shipping manifest papers as required by the U.S. Environmental Protection Agency.

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haz mat Nickname for **HAZARDOUS MATERIALS.**

hazardous shipping labels See **labels, D.O.T. HAZARDOUS MATERIALS WARNING.**

hazardous warning labels See **labels, D.O.T. HAZARDOUS MATERIALS WARNING.**

hazardous warning placards See **PLACARDS, D.O.T. HAZARDOUS MATERIALS WARNING.**

haz mat placards See **PLACARDS, D.O.T. HAZARDOUS MATERIALS WARNING.**

headache rack (Slang) Heavy bulkhead mounted behind the cab to protect it from a shifting load.

header bar A hinged, rear cross piece on open-top trailer, that can be swung out of the way to load high objects.

header board See **bulkhead.** Also known as headache rack (slang).

heater service Heat protection of freight that would be damaged by freezing.

high-cube A truck body or semi-trailer with above average cubic content. Usually constructed with low floors and thin walls.

hi-low Nickname for a forklift truck.

hole (Slang) A shift position in a gear box, e.g., low hole means the lowest gear.

hopper body Truck or trailer body capable of discharging its load through a bottom opening without tilting.

horse van body Truck designed for the transportation of valuable saddle horses.

hose tenders Devices that keep air and electrical lines between the tractor and trailer suspended and out of the way. Also known as "pogo sticks."

hot load (Slang) Rush shipment of cargo.

hydraulic brakes Brakes that depend on the transmission of hydraulic pressure from a master cylinder to the wheel cylinders.

hydrometer An instrument used to determine the state of charge of a battery.

hydroplaning Action produced by water on the roadway, in which tires lose traction (contact with the road) and skim along the water's surface, thus causing dangerous loss of directional control.

ICC See **Interstate Commerce Commission.**

identification lights Three lights mounted in a row on vertical centerline of the vehicle front and rear. Front lights are amber. Rear lights are red. Required by FMCSR on vehicles 80 inches or more in width. Also see **clearance lights.**

ignition coil A part of the electrical system that converts low voltage electricity to high voltage electricity.

import To receive goods from a foreign country.

in bond Merchandise on which a duty or import tax is still due (unpaid) is referred to as "in bond." Bonding guarantees that the duty will be paid to the government.

initial carrier The tranportation line that picks up a shipment from the shipper; in other words, the "first" carrier.

initial point The point at which a shipment originates.

injector A device found in a diesel engine that changes liquid fuel oil into a mist or spray and meters it to each cylinder.

injector pump A pump used to deliver fuel to the injectors under very high pressure.

inspection (vehicle) Checking over the vehicle parts and systems for problems and malfunctions and to see that everything is in order and in place. Pre-trip inspection is a thorough inspection done before the trip. Enroute inspections are made periodically during the trip. Post-trip inspections are done after the trip, so that problems and malfunctions can be reported to maintenance personnel.

instruments Devices for indicating or measuring conditions, performance, position, direction, etc.

insulated body Truck or trailer body designed for transportation of commodities at controlled temperatures. It may be equipped for refrigeration, heating or both.

insurance A contract binding a company to indemnify an insured party against a specified loss or damage. Motor carriers purchase many types of insurance, including cargo insurance, property damage insurance, public liability insurance, and workmen's compensation insurance.

intake manifold That part of the fuel system that carries the air or air/fuel mixture to the cylinders.

intake ports Provide the connecting passages from the outside of the cylinder heads to the inside head openings (the valves).

intake stroke Phase of the four-stroke cycle when fuel and air enter the cylinder.

intake valves Valves used in an engine to admit air into the combustion chambers of the cylinders.

interaxle differential lock See **differential lock**.

interchange point A station at which freight in the course of transportation is delivered by one transportation line to another.

interline freight Freight moving from point of origin to destination over the lines of two or more transportation companies.

interline waybill A waybill covering the movement of freight over two or more transportation lines.

internal combustion engine Any engine that burns fuel within itself, as a source of power.

internal expanding brake A type of brake designed with the brake shoes on the inside of the braking drum to expand against the inner surface of the drum.

interstate Between states. See **intrastate.**

Interstate Commerce The Interstate Commerce Act defines interstate as transportation from one state or territory of the United States or the District of Columbia to any other, or from any place in the United States through a foreign country to any other place in the United States, or from or to any place in the United States.

Interstate Commerce Act An Act of Congress regulating the practices, rates and rules of transportation lines engaged in handling interstate traffic.

Interstate Commerce Commission The Federal agency charged with enforcing the Acts of Congress affecting interstate commerce.

intrastate Within the borders of a State. See **interstate.**

Intrastate Commerce Transportation having origin, destination and entire transportation within the same State.

invoice (1) An itemized list of goods shipped to a buyer stating quantities, prices, fees, shipping charges, etc., often with a request for payment; (2) a shipment of invoiced goods.

irritating material or irritant See **HAZARDOUS MATERIALS.**

jacking Turning a tractor while backing so as to cause the trailer to assume a "jackknife" position. Combines with "chasing" to allow the trailer to be steered along the prescribed path. See **chasing.**

jacking it around Backing a semi-trailer around a very sharp curve.

jackknife (1) To place the trailer at a sharp angle to the tractor; (2) a type of skid in which either the tractor or the trailer loses traction and slides sideways.

Jake Brake (Slang) The Jacobs engine brake. Used as an auxiliary braking device on a tractor. Builds up back pressure in the engine by preventing the exhaust from escaping so that the engine slows.

Jeep wheel See **joe dog.**

joe dog Device with a dead axle that converts a single-axle tractor to a tandem-axle tractor. It hooks over the tractor's fifth wheel, replacing it with another for the semi to be hooked onto.

Johnson bar Type of prybar used to maneuver heavy cargo.

jumped the pin Missing the fifth wheel pin on the trailer when coupling tractor to trailer.

kingpin The bolt-like device on the underside of the front of a semi-trailer that fits into the tractor's fifth wheel to couple the tractor and the trailer together.

kingpin weight Weight of the trailer at the kingpin or the trailer weight applied to the fifth wheel.

knocked down A freight classification term denoting that an article is partially or entirely taken apart (not **set up**). Abbreviated KD.

known damage Damage discovered before or at the time of delivery of a shipment.

known loss Loss discovered before or at the time of delivery of a shipment.

labels, D.O.T. HAZARDOUS MATERIALS WARNING A regulation type label (or sticker) that is required to be placed on any package/container of hazardous materials which identifies the type of hazard.

laden weight The weight of a vehicle and its cargo. See **gross weight.**

lading That which constitutes a load. The freight in a vehicle.

landing gear A slang term for the support legs that hold up the front end of a semitrailer when it is disconnected from a tractor. See **dolly.**

layover To take a rest period of eight or more hours before continuing trip, or any extended off-duty period away from the home terminal.

layover time The non-working time that a road driver spends away from his home terminal before being dispatched to some other destination.

lead-acid battery A commonly used automotive battery in which the active materials are lead, lead peroxide, and a solution of sulfuric acid. See **storage battery.**

less-than-truckload rate Refers to cargo shipments of less than truckload size and weight; usually handled at proportionately higher rates and freight charges. Abbreviated LTL.

liable Legally bound or obligated to make good any loss or damage that occurs.

liability Anything for which a person is liable.

lien A legal claim upon goods for the satisfaction of some debt or duty.

line haul The movement of freight between major cities or terminals. Line haul operations do not include pick-ups or deliveries. Line haul service is also commonly referred to as over-the-road (abbreviated OTR) operations or "runs".

live axle Same as **drive axle** or **powered axle.**

livestock body Truck or trailer designed for the transportation of farm animals.

lock ring In three-piece wheel rims, the lock ring holdsl the side ring firmly on the rim base.

log See **log book.**

log body Truck or trailer body designed for the transporation of long items. See **pole trailer.**

log book, driver's daily A legal record kept by interstate truck and bus drivers in which they make entries showing their daily number of hours worked, vehicles driven, etc. The maintenance of such records is required by the Federal Motor Carrier Safety Regulations. Recently the name was officially changed to **Driver's Duty Status Record Book.**

long ton 2,240 pounds. Also called a **gross ton.**

louver Opening in cab, hood radiator sheel, or compartment for the purpose of ventilating.

low bed An open trailer with drop frame construction used primarily to haul heavy equipment. Also known as flat bed or low boy.

low boy See **low bed.**

low-air-warning device Any mechanical means of warning a truck driver that his vehicle is not maintaining the proper amount of air pressure needed to operate the brakes, etc. Can be a buzzer, a flashing red light on the instrument panel, or a small red metal flag that drops into the driver's line of vision.

low cab forward A tractor with the cab mounted forward of the engine to allow cab entry height to be reduced for ease of entry and exit.

lumber body Platform truck or trailer body with rollers designed for the transportation of lumber.

manifest A document describing a shipment or the contents of a vehicle or ship.

marker lights Also called clearance or running lights. See **clearance lights.**

marks Letters, numbers, and/or characters placed on a package for purposes of identification.

memorandum bill of lading A duplicate copy of a bill of lading.

mile 5,280 feet.

mileage Distance in miles.

minimum rate The lowest lawful rate that may be charged for transporting a shipment.

minnie (Slang) Less than 100-pound shipment.

mixed truckload A truckload of different freight articles combined into a single shipment.

mode Frequently used to refer to the basic divisions of the transportation industry. The principal modes of transportation are truck, rail, air and water.

moisture-release valve A valve in the air line that emits some air each time the brakes of the tractor are applied. Prevents water and moisture from collecting in the air system.

motor carrier An individual, partnership or corporation engaged in the transportation of property or persons.

motor vehicle Any vehicle, self-propelled or drawn by mechanical power, designed for operation on the highways or natural terrain in the transportion of property or passengers.

muffler Noise-absorbing chamber used to quiet the engine's noise.

mule (Slang) See **yard mule.**

multi-stop body Fully enclosed truck body with driver's compartment designed for quick, easy entrance and exit.

negligence Failure to exercise the degree of care the law demands.

nested Packed one within another.

net ton 2,000 pounds. Also called a **short ton.**

net weight (a) The weight of an article clear of packing and container; (b) as applied to a truckload, the weight of the entire contents of the truck.

nonflammable gas See **HAZARDOUS MATERIALS.**

nozzle Same as injector. See **injector**

octane number Rating applied to gasoline. Indicates the antiknock properties of the gasoline. The higher the number, the greater the antiknock properties. See **cetane number.**

odometer An instrument that measures the total number of miles traveled by a vehicle.

off-tracking A term used to refer to the path taken by the rear end of a vehicle when turning. The path of the rear wheels is shorter than the path of the front. The off-track is much shorter on a tractor-trailer. Drivers must compensate for off-tracking in turns and on curves.

ohm A unit of measurement of electrical resistance that allows an electromotive force of one volt to produce a current flow of one amphere.

ohmeter An instrument that measures the amount of resistance (in OHMs) in a circuit or in an electrical component outside the circuit.

oilfield body Heavily constructed platform-type truck body equipped with instruments for oil drilling.

oil filter Device for cleaning and purifying the engine lubricating oil.

oil pressure gauge Measures pressure of engine lubricating oil. Pressure varies with engine speed and oil viscosity. Sudden drop of pressure indicates a problem.

oil seal A device used to retain lubricant in the bearing area of the wheel. The sealing part of the seal is usually made of a resilient material such as synthetic rubber or leather, which is assembled into a wheel or the hub bore.

open top (trailer) A truck or trailer body with sides but without any permanent top, often used for heavy equipment that must be lowered into place by crane. Nicknamed **ragtop.**

order bill of lading See **bill of lading.**

organic peroxide See **HAZARDOUS MATERIALS.**

ORM-A See **HAZARDOUS MATERIALS.**

ORM-B See **HAZARDOUS MATERIALS.**

ORM-C See **HAZARDOUS MATERIALS.**

ORM-D See **HAZARDOUS MATERIALS.**

ORM-E See **HAZARDOUS MATERIALS.**

out-of-service driver Driver declared out-of-service by a government representative because of hours of service violations. The out-of-service form indicates when such a driver may commence driving again.

out-of-service vehicle A vehicle that cannot pass the government safety inspection and is declared out-of-service. Cannot be driven until the problem or problems are corrected or repaired.

outriggers Devices used for increasing width of low boy trailer.

over freight Freight separated from its waybill and bearing no identifying marks. See **astray freight.**

over on bill Freight in excess of that specified by the freight bill or the bill of lading.

over, short and damaged (OS&D) Discrepancies between freight on hand and freight shown on the bill. Freight not covered by billing is "over." If some is missing, it is "short." Freight received in bad condition, is "damaged." Freight agents file an OS&D report showing these discrepancies.

over without bill When a terminal has freight without its bill of lading or freight bill.

overage Freight in excess of the quantity or amount shown on the bill of lading or other shipping document.

overcharge To charge more than the amount provided in the proper tariff.

overdrive Refers to a condition in which the vehicle's transmission is in a gear having a ratio greater than 1:1, that is, the engine crankshaft turns at a slower rate than the vehicle drive shaft. Opposite of **underdrive.** (Also see **direct drive**).

overdriving the headlights Driving at a speed that will not permit you to stop your vehicle within the distance you can see ahead.

overhang (front) Distance from centerline of front axle to front of vehicle.

overhang (rear) Distance from centerline of rear axle to rear of vehicle.

overriding the governor (overspeeding) When the weight of the vehicle drives the engine beyond governed speed. Happens on hills when vehicle is not in a low enough gear and is not supplemented as necessary by light, steady brake application. The governor does not control the engine speed when the vehicle is driving the engine.

oversized vehicle Any vehicle whose weight and/or dimensions exceeds State regulations.

over-the-road (OTR) See **line haul operation.**

owner-operator A trucker who both owns and drives his tractor.

oxidizers See **HAZARDOUS MATERIALS.**

packing, improper Any packing that does not comply with the classification rules and regulations for proper packing.

packing list A detailed specification of packed goods.

pajama wagon (Slang) Sleeper tractor.

pallet A portable platform for holding material for storage or transportation.

palletized Stacked on pallets.

panel body Small, fully enclosed truck body often used for small package delivery.

parallel circuit A circuit in which all control and current consuming devices are arranged in several independent branches. Each branch provides a separate current path through the circuit components on this branch only. See **series circuit.**

payload The cargo or freight that a vehicle hauls.

peddle run Truck route with frequent delivery stops.

peg leg (Slang) Liftable axle with only one wheel at each end.

perishable freight Freight subject to decay or deterioration.

permit A document granting permission.

pig Trailer transported on flat rail car.

piggyback Transportation of a highway trailer on a railway flat car.

pigtail (Slang) Electrical cable used to transmit power from the tractor to trailer.

pilferage Stealing.

pintle hook Coupling device at rear of truck for the purpose of towing trailers.

piston A device that moves up and down in the engine cylinder and provides power to the crankshaft.

PLACARDS, D.O.T. HAZARDOUS MATERIALS WARNING A regulation type of sign that is required to be displayed on all four sides of a motor vehicle when it is hauling hazardous materials.

platform body Truck or trailer body with a floor, but no sides or roof.

ply A layer of rubber-coated parallel cords on a tire.

point of origin The terminal at which a shipment is received by a transportation line from the shipper.

point system States assign points for traffic violations toward driver license suspension.

poison A See **HAZARDOUS MATERIALS.**

poison B See **HAZARDOUS MATERIALS.**

polarity The condition of having opposite poles. In electricity, the poles are the positive and negative terminals posts of a battery. In magnetism, the poles (north and south) are the ends of a magnet or electromagnet.

pole trailer Trailer composed of a single telescopic pole, a tandem rear-wheel unit, and a coupling device used to join the trailer to a tractor. Pole trailers are used to transport logs or similar items, when chained together becomes a rigid unit thereby serves as its own trailer body. Pole trailers are adjustable in length.

ports Apertures in engine block for the passage of gas or liquid.

possum belly (Slang) Livestock trailer with a drop frame to haul animals on 2 levels.

post-trip inspection See **inspection (vehicle).**

pot torches Safety equipment used on a highway to warn traffic of an obstruction or hazard.

power-lift tail gate A power-operated tail gate capable of lifting load from street level to the level of the truck or trailer floor.

power stroke Phase of the four-stroke cycle when fuel is ignited and combustion take place.

power train The series of parts that transfer the power of the engine to the wheels. Same as drive train.

powered axle See **drive axle.** Commonly called a **live axle.**

prepaid A term denoting that transportation charges have been or are to be paid at shipping point.

prepay To pay before or in advance.

pressure regulator (fuel) A bypass valve to regulate the pressure of the fuel supplied to the injectors. Bypassed fuel flows back to the suction side of the gear pump.

pre-trip inspection See **inspection**.

preventive maintenance A systematic checking and care of equipment to keep repairs to a minimum.

private carrier A company that is not primarily engaged in transportation business and that hauls its own property in its own vehicles. Private carriers do not have to obtain operating authority from the Interstate Commerce Commission, but they must comply with the Federal Motor Carrier Safety Regulations of the Department of Transportation.

privileged vehicle In any situation, the vehicle which has the right-of-way over other vehicles under the law. Also see **burdened vehicle**.

progressive shifting A process of shifting high torque rise engines that involves shifting at lower rpms at slower speeds, and at progressively higher rpms as the speed of the vehicle increases.

prohibited articles Articles of freight which will not be handled.

pro number The abbreviation of the word progressive and is usually prefixed to an agent's record numbers on freight bills, etc.

proof of delivery A motor carrier establishes proof of delivery from delivery receipt copy of freight bill signed by consignee, at time of delivery. This is legal proof of delivery.

public service commission Same as **public utilities commission**.

public utilities commission State agency that regulates public utilities and transportation companies. Sometimes called **public service commission**.

pull the pin Release the fifth wheel lock.

pup (Slang) A short four-wheel trailer which is pulled behind a semi-trailer or a straight truck.

put on the air (Slang) Apply the brakes.

put on the iron (Slang) Put on the tire chains.

pyrometer An instrument that registers the temperature of the exhaust gases.

radiator A device of tubes and fins through which circulating water passes to give off excess heat and thus cool the engine.

radius rods Rods attached to frame and axles to prevent misalignment.

rag top (Slang) Open-top trailer with a tarpaulin. See **open top.**

rain cap Protection device used on exhaust stacks to prevent rain entry when the engine is stopped. Opens and closes automatically. Opens by the pressure of exhaust gases passing out of the stack. When exhaust stops (with engine shut off), the rain cap closes.

reaction time The time that elapses between the point that a driver recognizes the need for action and the time that he takes the action.

recap (driver's daily log) A summary of the hours that a driver has worked. Used to figure out how many hours a driver can work under hours of service regulations. Short for "recapitulation."

recap (tires) (1) To recap a tire by bonding new tread rubber to the used tire; (2) a tire that has been recapped. See **full capping** and **half capping.**

recharge (battery) Feeding a direct current into the cells of a storage battery.

reciprocity (1) Mutual action; (2) exchange of privileges, such as between two states.

reconsignment A change (made in transit) in the route, destination, or consignee as indicated in the original bill of lading.

reefer (Slang) See **refrigerated trailer.**

refrigerated trailer An insulated van-type truck or trailer body equipped with a refrigeration unit. Used for carrying perishable goods. Also called a **reefer.**

regroove To cut new grooves into a tire. This can be done only on tires that are made specifically to be regrooved. They are marked "regroovable."

regulator See **voltage regulator.**

relay emergency valve A combination valve in an air brake system, which controls brake application and which also provides for automatic trailer brake application should the trailer become disconnected from the towing vehicle.

relay valve Valve used to speed up the application and release of the rear wheel brakes.

reparation Compensation for damage.

reservoir pressure air gauge See **air pressure gauge.**

reshipment Goods sent to another destination under conditions which do not make the act subject to reconsignment rules and charges of the carrier. See **reconsignment.**

resistence Opposition to the free flow of electrical current in a circuit.

resistor Any device that "uses up" voltage by opposing, or resisting, the flow of electrical current. Resistors may be current consuming devices such as lamps or motors, or devices which are designed for the purpose of using a specific amount of voltage.

restricted articles Types of freight that cannot be handled at all or may only be handled under certain specific conditions.

revenue waybill A waybill showing the amount of charges due on shipment.

revolutions per minute The number of turns or rotations the engine makes in a minute (abbreviated RPM). Engine RPM is expressed in hundreds on the tachometer.

ride shotgun (Slang) To ride in the passenger seat of the tractor. Said of a co-dirver.

rig (Slang) Truck; tractor-semi-trailer; truck and full trailer, or other combination vehicle.

road, primary A main road or highway.

road, secondary Not a main road or highway. Usually narrower, less direct, and often more winding than a primary road.

rock it To free vehicle from mud or snow by alternately driving forward and reverse.

rolling radius Distance from center of the tire to ground.

rolltop A truck or trailer body with a sliding roof to permit overhead crane loading of freight.

route (1) The course or direction that a shipment moves; (2) to designate the course or direction a shipment shall move; (3) the carrier or carriers over which a shipment moves.

runaway truck ramp See **escape ramp.**

running lights Same as clearance or marker lights. See **clearance lights.**

rural Of or characteristic of the country (as opposed to the city).

saddle tanks Barrel type fuel tanks that hang from the sides of the tractor's frame.

seal A security device to assure that truck doors have not been opened in transit.

secure (1) To guard or protect, such as to secure the scene of an accident; (2) to make firm or tight, such as the cargo tie-downs or to secure the truck after parking; (3) to obtain, such as to obtain help; (4) safe and free from danger, such as secure place to stop.

semi (Slang) For either a tractor-trailer combination; or for a semi-trailer.

semi-trailer A trailer that has only rear axles. The front of a semi-trailer either rests on the tractor or is supported by its landing gear when coupled. See **full trailer.**

series circuit A circuit in which all controls and current consuming devices are connected in a single line, so that current must pass through each device in sequence. See **parallel circuit.**

series-parallel circuit A circuit that is made up of combination of series and parallel circuits.

service (air line) See **air lines.**

set up A freight classification term denoting that an article is put together in its complete state. Not **knocked down.**

shipper A person or agent that ships freight.

shipping labels, hazardous See **Labels D.O.T. HAZARDOUS MATERIALS WARNING.**

shipper's load and count Indicates that the contents of a truck were loaded and counted by the shipper and not checked or verified by the transportation line.

shipper's order The document authorizing release of a shipment traveling on an order bill of lading. See **bill of lading.**

shipping order Instructions to carrier for transportation of a shipment. Usually it is a copy of the bill of lading. Used also as record by the freight agent at origin.

shipping papers Papers used in connection with movement of freight.

shipping permit Authority issued by a transportation line permitting the acceptance and forwarding of goods, against the movement of which, an embargo has been placed.

shock A frequent condition of accident victim in which there is a lack of sufficient blood circulation.

short circuit See **circuit**.

short ton 2,000 pounds. Also called a **net ton**.

shortage When quantity of freight received is actually less than that shown on the documents.

shut-down valve (electric solenoid) Permits the fuel to be shut off or turned on through the use of a switch key similar to that used in automobiles.

shut-down valve (manual type) Located on top of the fuel pump used to shut off fuel supply to the engine. When the plunger is pushed in, the fuel passage to the injectors is opened. When it is pulled out, the fuel passage is closed. It is important to keep the valve pulled out in the "Off" position whenever the engine is not running.

sight gauge A glass window for determining fluid levels, as in a radiator.

sight side The side of the tractor visible by driver, i.e., driver's side. Opposite of **blind side**.

single axle (Slang) Slang for either a tractor with one front axle and one rear axle or a semi-trailer with only one axle.

single drop frame A drop frame trailer with one drop, immediately behind kingpin. See **drop frame**.

single-reduction rear axle A rear end that reduces the drive line rpm in relation to the rear wheel rpm by means of a single combination of gears.

skid (1) A wooden platform on which heavy articles or packaged goods are placed to permit handling; (2) failure of tires to grip the roadway because of loss of traction.

skinnie axle (Slang) A trailer or tractor equipped with only one rear axle.

slack adjuster An adjustable device located on the brake chamber pushrod that is used to compensate for brake shoe wear.

sleeper Truck with a sleeping compartment in the cab.

sleeper berth Area in a tractor where a driver can sleep. Sleeper berths must meet standards set by the Federal Motor Carrier Safety Regulations.

sleeper cab A truck or tractor cab incorporating a bed or bunk.

sliding fifth wheel A fifth wheel assembly capable of being moved forward or backward on the truck tractor to obtain desired load distribution between tractor and trailer axles.

sliding tandem An adjusted bogie beneath the trailer that can be moved forward or backward to distribute the weight between tractor and trailer axles.

slip-seat Relay operation where drivers are changed periodically, but the truck continues from point of origin to final destination of the shipment.

smoker (Slang) Tractor emitting excessive smoke from exhaust.

smokestack See **stack**.

snorkel The extension of pipe for the air intake side of the air cleaner. It enables clean air to be taken in from on the top of the cab.

snub-nose Conventional style tractor with the engine protruding into the cab in order to shorten overall length of the tractor.

solenoid An electromagnetic device that can be used to open and close a circuit (like opening or closing a valve, or engaging the gear of a motor).

spark plug A device in the top of the cylinder composed of two electrodes that provide an electrical spark to ignite the gasoline and air mixture in a gas engine.

speedometer Indicates road speed in miles per hour.

spin out Loose traction on a slippery roadway.

split pickup or delivery An accessorial service of picking up or delivering portions of volume shipments at more than one place within origin or destination point boundaries.

splitter Mechanism that divides a gear into two or more ratios such as **direct, overdrive,** or **underdrive.**

spontaneously combustible materials See **HAZARDOUS MATERIALS.**

spot the trailer To park and uncouple a trailer at a designated location.

spotter Worker in terminal yard who parks vehicles brought in by regular drivers. Also a supervisor who checks the activities of drivers on the road.

spread See **bridge.**

spread tandem A two-axle assembly in which the axles are separated by distances substantially greater than that in conventional assemblies.

spring brake A device that consists of a conventional brake chamber and an emergency or parking brake mechanism for use on vehicles equipped with air brakes. The service brake chamber portion of the spring brake is identical to, and functions the same as a brake chamber. The rear portion of the spring brake, sometimes called the "piggyback," houses a large and powerful spring and diaphragm, which under normal conditions, is held in the released position (spring compressed) by air pressure. If air is exhausted from the spring cavity, the spring expands, forcing the diaphragm, push plate, and rod forward, applying the vehicle brakes. A mechanical release bolt at the rear of the chamber is provided to mechanically cage the spring and release the brakes, if necessary.

spring brake control Controls spring-loaded parking brakes.

stabilizer Device used to stabilize vehicle during turns. Also called a **sway bar.**

stack Vertically mounted pipe (or pipes) that discharges the engine exhaust to the atmosphere. See **exhaust pipe.**

stake body Truck or trailer platform body with readily removable stakes which may be joined by chains, slats, or panels.

starter motor An electric or air powered motor used to set the crankshaft in motion in order to start the engine.

static electricity An electrical charge produced by the gathering of free electrons in one place. The electrons remain at rest until they find a conductor that provides a path to an opposing charge.

steering axle An axle through which directional control of the vehicle is applied. A steering axle may be powered or non-powered. A tractor may have more than one steering axle.

stop (engine) and emergency stop Some tractors are equipped with a starter button and an "engine stop" switch. The engine stop is used to shut off the engine. Some tractors are equipped with an "emergency engine stop" switch to be used only when the engine starts to "run away" (exceeding the safe upper RPM limits). Once the emergency stop has been used, the engine will not start again until a mechanic has made repairs.

stopping distance See **total stopping distance.**

stopping in transit to finish loading or unloading An accessorial service of halting volume shipments to finish loading or do partial unloading at points between origin and final destination.

storage Safekeeping of goods in a warehouse.

storage battery A device that stores voltage and supplies electrical current by means of a chemical reaction between different chemicals. See **lead-acid battery.**

storage charges Payment due for storage.

storage in transit Temporary warehousing of a shipment at a point between origin and destination.

store door delivery Movement of goods to a consignee's place of business.

straight bill of lading See **bill of lading.**

straight job (Slang) Truck with body built onto its chassis; also called **straight truck.**

straight truck A truck with the body and engine mounted on the same chasis. (As contrasted to a combination unit such as tractor-trailer).

strip the trailer (Slang) Unload the trailer.

stroke The maximum distance a piston moves in a cylinder.

suburban Of or characteristic of the suburbs, as opposed to city or **rural.**

suburbs Areas on or near the outskirts of a city.

supercharger A type of blower, connected to the engine crankshaft, that forces air into the intake manifold at higher than atmospheric pressure to increase engine power and performance. See **blower.**

supply (air line) See **air lines.**

supply lines (fuel) The lines that carry a supply of fuel to each injector. Fuel enters the inlet connection and then the injectors.

surcharge A charge above the usual or customary freight charge.

surtax An additional or extra tax.

suspension The system of springs, etc., supporting a vehicle upon its undercarriage or axles.

swamper (Slang) A helper who rides with the driver.

sway bar See **stabilizer.**

swinging meat Sides of slaughtered beef, pork, lamb, etc. that are suspended from special racks in a refrigerated trailer.

synchronized transmission A transmission in which the gears are so constructed as to allow smooth shifting without the need to double-clutch.

tachograph A recording device in a tractor that automatically records the number of miles driven, the speed, the number of stops, and other pertinent statistics.

tachometer A device in the tractor, located on the instrument panel, that indicates the revolutions per minute of the engine's crankshaft.

tag axle The rearmost axle of a tandem-axle tractor if that axle serves only to support additional gross weight. A tag axle does not transmit power.

tailgating Following the vehicle ahead of you at an unsafe distance, i.e., less than your **total stopping distance**.

tailpipe Horizontally mounted pipe that discharges the engine exhaust to the atmosphere. See **stack**.

tandem axle An assembly of two axles, either, none or both of which may be powered.

tandem drive axles Tandem axles on a tractor, both of which propel the vehicle. Same as **twin screw**.

tank trailer A semitrailer consisting of a metal tank for carrying liquid or dry bulk. Also called a tanker.

tanker See **tank trailer**.

tare weight (1) As applied to a loaded motor vehicle, tare weight is the weight of the vehicle exclusive of its contents. (2) Also refers to the weight on a container and/or the material used in the container for packing the merchandise to be shipped.

temperature gauge A device that indicates the temperature of such things as coolant, lubricating oil and gear lube.

tender The offer of goods for transportation, or the offer to place trucks for loading or unloading.

terminal A building for the handling and temporary storage of freight as it is transferred between trucks, i.e., from a city pickup to a line haul truck.

terminal carrier The line haul motor carrier making delivery of a shipment at its destination. Terminal carrier means the last or final carrier.

terminal charge A charge made for services performed at terminals.

terrain Natural features of the land.

test lamp A device used to check an electrical circuit for problems.

theft Feloniously taking and removing property with intent to deprive the rightful owner, the taking of the entire container or article. See **pilferage.**

thermostat Device used to maintain temperature in the engine's cooling system within a desired range by restricting the coolant flow.

throttle Valve that regulates the amount of fuel vapor entering an internal combustion engine; controls the engine speed. Also see **hand throttle** and **accelerator.**

through bill of lading See **bill of lading.**

tie rod Part of the tractor's steering system, it is the connecting rod between the steering arms.

tires, belted bias Body plies are same as those for bias tires. In addition, tires have belt plies that constrict the diameter and give greater rigidity to the tread. Belts are heavier construction and the cords lie in a more circumferential direction than breakers on bias tires.

tires, bias Body plycords lie in a diagonal direction from bead to bead. Tires may also have narrow plies under the tread, called breakers, with cords that lie in approximately the same direction as the body ply cords.

tires, radial Body plycords are placed perpendicularly across the tread from bead to bead. In addition, radial tries have belt plies that run circumferentially around the tire, under the tread. They construct the radial ply cords and give rigidity to the tread, resulting in less rolling resistance which gives better fuel economy.

tires, wide base Same diameter as conventional tires, but have a wider base that provide greater ground contact. Sometimes used to replace dual tires, resulting in cost and weight savings.

toe-in The amount of distance which the front of the front wheels are closer together than the rear of the wheels. Front tires are toed-in to improve steering and increase tire life.

toe-out Opposite of **toe-in.**

tolerance Permissible variation in dimension, weight, etc. For example, some states allow a tolerance in their maximum truck weight limits.

toll A charge made for the use of a facility such as a bridge or turnpike.

ton-mile A unit of measure. The movement of a ton of freight one mile.

tonnage Number of tons.

torque Force having a twisting or turning effect.

torque tube Tube enclosing the drive shaft. Transmits forward or aft motion from rear axle.

total engine displacement Piston displacement times the number of cylinders. Expressed in cubic inches.

total stopping distance The distance the vehicle travels between the time the driver recognizes the need to stop and the time the vehicle comes to a complete stop. Total stopping distance includes perception, reaction, brake lag and braking distance.

trace To check the movement of a shipment.

tracer A request that a carrier locate a shipment to speed its movement or to establish delivery. Or a request for an answer to a previously filed claim or other communication.

traction Adhesive friction, as of tires on pavement.

tractor protection valve Controls flow of compressed air from tractor to trailer; when closed, stops flow of air to trailer. When this happens, the trailer brakes will apply. Used to make sure that air is always available for tractor brakes. Must be in "Normal" position when tractor is hooked up to trailer and in "Emergency" position to unhook trailer.

traffic Persons or property carried by transportation lines.

trailer See **full trailer**; **semi-trailer**.

trailer brake A hand-operated remote control that applies trailer brakes only. Located on the steering column or dash. Must never be used for parking. Also called hand valve, trolley brake, trolley valve handle, trailer hand brake, and independent trailer brake.

trailer hand brake See **trailer brake.**

transfer pump A pump used to move fuel from fuel tank to injectors or carburator.

transmission Selective gear box providing various combinations of gear ratios.

transport To move traffic from one place to another.

transportation The movement of traffic from one place to another.

treadle valve See **foot brake valve.**

tri-axle An assembly of three rear axles, any or all of which may be powered.

triples A combination consisting of a tractor, a semi-trailer and two full trailers, coupled together. Known as triple headers or triple bottoms.

trolley brake See **trailer brake**.

trolley-valve handle Operates the trailer's brakes. See **trailer brake.**

trucking industry The business activity of carrying goods by truck. Used generally to include carrier, drivers, warehouse and terminal employees, and all others who are directly or indirectly involved in trucking.

truckload (1) Quantity of freight that will fill a truck, (2) quantity of freight weighing the maximum legal amount for a particular type of truck, (3) when used in connection with freight rates, the quantity of freight necessary to qualify a shipment for a truckload rate, which is cheaper than a **less-than-truckload rate**. Abbreviated TL.

turbocharger A type of blower, powered by engine exhaust gases, that forces air into the intake manifold at higher than atmospheric pressure to increase engine power and performance. See **blower**.

turn around A type of trip or "run" in which the driver returns to the origin point immediately after his vehicle is unloaded and reloaded.

twins See **doubles**.

twin screw A truck or tractor with two rear axles, both driven by the engine. Same as **tandem drive axles**.

twin trailers See **doubles.**

two-cycle engine A piston-type internal combustion engine that produces power on every downstroke of the piston.

two-speed axle A drive axle capable of being shifted through two gear ranges in order to double the number of gears available from the transmission.

unclaimed freight Freight which has not been called for by the consignee or owner, or freight that cannot be delivered.

underdrive Refers to a condition in which the vehicle's transmission is in a gear having a ratio less than 1:1, that is, the engine crankshaft turns at a faster rate than the vehicle's drive shaft. Opposite of **overdrive.** (Also see **direct drive**).

universal joint A joint or coupling that permits a swing of limited angle in any direction; used to transmit rotary motion from one shaft to another not in line with it.

unstable cargo Cargo that cannot be completely secured against movement, such as cattle, swinging meat, liquids.

unstable freight See **unstable cargo.**

urban Of or characteristic of the city (as opposed to **rural**).

vacuum brake system A brake system in which the brake mechanism is activated by a vacuum.

valuation, actual Actual value of goods required to be shown on bill of lading by shipper, when rate to be applied is dependent on that fact.

valve A device that opens and closes openings in a pipe, tube, or cylinder.

V-belt drive Power transmitted from the drive wheels to a dead axle by means of a V-belt connection. See **belt drive axle.**

V.C.R. Driver's daily vehicle condition report.

via By the way of.

viscosity Resistance of a fluid to flow, as in engine oils.

volt A unit of measurement of electrical potential.

voltage The electromotive force that causes electrons to flow. Voltage is the difference between two opposing charges, such as the positive and negative plates of a storage battery. Voltage can be present without current flow. But current cannot flow unless voltage is present.

voltage drop The "using up" of voltage in a circuit. Voltage drop can be caused by resistance in the circuit wiring, current consuming devices (such as lamps, motors etc.) and by resistors.

voltage regulator A device that controls the voltage output of a generator.

voltmeter Indicates output of alternator in volts.

warehouse A place for the reception and storage of goods.

warehouse receipt A receipt for goods placed in a warehouse (may be issued as a negotiable or non-negotiable document).

warehouseman A person in the business of receiving goods and merchandise to be stored in his warehouse.

warehousing The storing of goods.

warning labels See **LABELS, D.O.T. HAZARDOUS MATERIALS WARNING.**

water level warning light Lights up when coolant level in radiator drops below required level. Similar lights will indicate low oil pressure or high coolant temperature, depending on the type of engine.

water pump Pump that circulates the coolant through the engine cooling system.

water reactive material See **HAZARDOUS MATERIAL.**

water temperature gauge Indicates temperature of engine coolant.

watt Unit of measurement of electrical power.

waybill A document prepared by a transportation line at the point of origin of a shipment, showing the point of origin, destination, route, consignor, consignee, description of shipment and amount charged for the transportation service. Forwarded with the shipment, or sometimes direct by mail, to the agent at the transfer point or waybill destination. The waybill is basically a description of goods and shipping instructions.

weighmaster A person who operates a scale for the weighing of freight or motor vehicles. A certified weightmaster is one who has been licensed by some governmental authority as skilled in the art of proper weighing.

weight sheets Itemized list furnished by shippers to weighing bureaus, itemizing articles in each consignment.

wet clutch A type of clutch that operates in an oil bath.

wet goods Liquids.

wet tank Part of the air brake system. Compressed air produced by the compressor goes to the wet tank, which collects any water and engine oil that the air has in it. This tank must be drained at least once a day.

wheelbase Distance (in inches) from center of hub of front wheel of a vehicle to center of hub of back wheels or the center of the space between the tandems.

winch rig Straight truck or tractor with a winch and/or a hoist.

woodchuck (Slang) Driver with low job seniority.

wrecker Truck designed for hoisting and towing disabled vehicles.

yardbird (Slang) A driver who connects and disconnects tractor-semi-trailer combinations and moves vehicles around the terminal yard.

yard goat (Slang) See **yard mule.**

yard jockey (Slang) Person who operates a yard tractor or yard mule, a special tractor used to move semi-trailer around the terminal yard.

yard mule (Slang) Tractor used to move semi-trailers around the terminal yard.

LIST OF ABBREVIATIONS

amt	amount
amp	ampere
APU	authorized pickup
arr	(1) arrive, (2) arrival
art	article
ATA	American Trucking Associations, Inc.
av	average
avg	average
A/W	actual weight
BB	break bulk
BBC	length of tractor in inches from bumper to back of cab
bbl	barrel
BC	distance in inches from back of cab to end of frame
BHP	brake horsepower
BL or B/L	bill of lading
bls	bales
BMCS	Bureau of Motor Carrier Safety
BTW	behind-the-wheel
bu	(1) bushel, (2) bureau
bx	box
CA	distance in inches from back of cab to centerline rear axle
CAE	cab-alongside-engine
COE	cab-over-engine
CBE	cab-beside-engine or cab-behind-engine
con	conventional
chg	charge
ck	(1) cask(s), (2) check
CL	(1) connecting line, (2) car load
c/o	care of
COD	cash (or collect) on delivery
coll	collect
comb	combination
com'l	commercial
cr	(1) credit, (2) creditor
CR	carrier's risk
cty	county
cu ft	(1) cubic foot, (2) cubic feet
cwt	hundred weight
cyl	cylinder
dba	doing business as
dely	delivery
diam	diameter
diff	differential
disc	discount
disp	(1) dispatch, (2) dispatcher
dist	(1) district, (2) distance
div	division
dk	dock
D.O.T.	Department of Transportation
EB	eastbound
eg	exempli gratia (for example)
eq	equal
est	estimated
est wt	estimated weight
ETA	estimated time of arrival
etc	et cetera (and other things; and so forth)
ETD	estimated time of departure
ex	(1) exchange, (2) example
ex BL	exchange bill of lading
exp.	(1) export, (2) express, (3) expense
FA	(1) free astray, (2) freight astray
FB	Freight Bill
FHWA	Federal Highway Administration
FMCSR	Federal Motor Carrier Safety Regulations
FOB	free on board
frt	freight
ft	(1) feet, (2) foot, (3) fort
gal	gallon
GCW	gross combination weight
gen'l	general
gr	gross
GT	gross ton
GVW	gross vehicle weight
hdqrs	headquarters
hgt	height
hhd	hogshead
HP	horsepower
HQ	headquarters
ht	heat or height
ie	id est (that is)
IB	(1) inbound, (2)in bond
ICC	Interstate Commerce Commission
IL	Interline
imp	import
inc	(1) inclusive, (2) incorporated
ins	insurance
inter	interstate
intra	intrastate
inv	invoice
it	item
KD	knocked down
LCF	low cab forward of engine
LCL	less than a car load
liq	(1) liquor, (2) liquid
L&D	loss and damage
lg tn	long ton (2,240 lbs)
LPG	liquified petroleum gas

lt	long ton
LTL	less than truckload
max	maximum
mdse	merchandise
memo	memorandum
min	minimum
MC	(1) minimum charge (2) motor carrier
min wt	minimum weight
misc	miscellaneous
MO	money order
mpg	miles per gallon
mph	miles per hour
mty	empty
N B	northbound
no	number
nos	numbers
nstd	nested
nt	net ton
ntfy	notify
O/C	overcharge
OR	owner's risk
OS&D	over short and damaged
OTR	over-the-road
oz	ounce
pcs	pieces
PD	property damage
pkg	package
PL	public liability
PL&D	public liability and property damage
PP	(1) prepay (2) prepaid
PSC	Public Service Commission
psi	pounds per square inch
pt	(1) point (2) pint (3) port
PTCA	Private Truck Council of America
PU	pick up
PUC	Public Utilities Commission
PU&D	pick up and delivery
qt	(1) quart (2) quantity
R/C	reconsignment
refrig	(1) refrigerator (2) refrigeration
reg	regulations
rel	released
rep	(1) report (2) representative
rpm	revolutions per minute
rte	route
SB	southbound
shtg	shortage
sh tn	short ton (2,000 lbs)
SL&C	shipper's load and count
SO	shipping order
SR	shipping receipt
st	short ton
sta	station
SU	set up
SC	surcharge
term	terminal
terr	territory
tfr	transfer
TL	Truck Load
tn	ton(s)
tnge	tonnage
tot	total
trans	transportation
UC	undercharge
val	value
viz	namely
vol	volume
wdt	width
WB	westbound
whse	warehouse
wt	weight
yr	year

SECTION 1
BASIC OPERATION

SECTION I
BASIC OPERATION

This section is designed to introduce students to basic operation of the tractor-trailer. It consists of the following units:

Unit 1.1 - Orientation--To introduce students to the tractor-trailer driver training curriculum and the components of a tractor-trailer.

Unit 1.2 - Control Systems--To introduce students to vehicle instruments and controls.

Unit 1.3 - Vehicle Inspection--To stress the importance of vehicle inspections and help develop the skills necessary for good inspections.

Unit 1.4 - Basic Control--To prepare students to safely perform basic control maneuvers.

Unit 1.5 - Shifting--To introduce shifting patterns and procedures to the students so that they can proficiently perform basic shifting maneuvers.

Unit 1.6 - Backing--To prepare students to back the trailer safely.

Unit 1.7 - Coupling and Uncoupling--To develop the skills necessary for safe coupling and uncoupling of the tractor-trailer units.

Unit 1.8 - Proficiency Development: Basic Control--To enable students to gain proficiency in basic control needed to safely undertake the instruction in safe operating practices of Section II.

Unit 1.9 - Special Rigs--To introduce students to the characteristics of special rigs, i.e., those different from the standard vehicles taught in this curriculum.

Introductory Units

The first three units are introductory. Unit 1.1 introduces students to tractor-trailer operation and the course. Unit 1.2 introduces them to the controls and instruments that they will be using to operate the vehicle throughout the other units of the Section. Unit 1.3 introduces the students to vehicle inspection. Inspection is placed early in the curriculum in order that pretrip inspections may be made a part of every day's activity, thus helping to develop a high degree of proficiency, as well as instilling the habit of performing a vehicle inspection.

Unit 1.9 (SPECIAL RIGS) is also introductory, and is used to acquaint students with the characteristics of various special rigs.

NOTE: For purposes of this curriculum anything other than a 5 axle, 18 wheel rig with a 40 to 45 foot long, dry freight van is considered to be a special rig. This unit is not taught until the end of the sequence in order to have hands on instruction begin as soon as possible.

Vehicle Operation

The heart of Section I is the instruction in operation of the vehicle. This includes Unit 1.4 through Unit 1.7. The order is one of increasing difficulty, from simply getting the vehicle in motion to performing all the basic maneuvers of which the vehicle is capable. Coupling and uncoupling the trailer is introduced in Unit I in order to provide students an opportunity to practice the activity on a day-to-day basis.

Proficiency Development

Unit 1.8, Proficiency Development, provides students an opportunity to practice development in controlling the motion of the vehicle. Most of the proficiency development takes place on the range and may be spread throughout the entire course. However, if students develop enough proficiency to safely begin driving on public highways, they are to be given an opportunity to do so. The purpose of this onstreet practice is to give them enough ability and confidence in handling the vehicle to begin applying the safe operating practices taught in Section 2.

UNIT 1.1
ORIENTATION

UNIT 1.1 ORIENTATION

PURPOSE

The purpose of this unit is to introduce students to the tractor-trailer driver training curriculum and the components of a tractor-trailer.

OBJECTIVES

Performance Objectives

There is no terminal objective in this unit. The focus of the unit is to introduce tractor-trailer driving, the curriculum, and the student's responsibilities.

Knowledge Objectives

Students must know

- major components of a tractor-trailer.
- general operation of the trucking industry.
- course objectives.
- rules of student conduct during instruction.
- safety rules to be observed during range and street instruction.
- methods of evaluating student performance and standards to be met.
- minimum requirements for graduation.

Skill Objectives

None

Attitude Objectives

Students must believe that

- school safety regulations are for their protection.
- all school regulations must be obeyed.

Lessons

Lesson 1.	Orientation to Tractor-Trailer Driver Training (Classroom)	2 hours
Lesson 2.	Introduction to the Tractor-Trailer (Classroom)	1 hour 15 minutes
Lesson 3.	Orientation to the Tractor-Trailer (Lab)	1 hour

LESSON 1 ORIENTATION TO TRACTOR-TRAILER DRIVER TRAINING (CLASSROOM)

Overview

Time Allotted: 2 hours

Prerequisites: Course entrance requirements

Purpose:

The purpose of this lesson is to introduce students to tractor-trailer driving and the requirements of this course.

Materials

Instructional Aids

Visuals 1-11

Student Material

Course Outline, in Unit 1.1 of Student Manual
Student Rules, in Unit 1.1 of Student Manual
Rules for Range Exercises, in Unit 1.1 of Student Manual
Rules for Onstreet Driving, in Unit 1.1 of Student Manual
Some Tips on How to Study, in Unit 1.1 of Student Manual
Student Evaluation Procedures, in Unit 1.1 of Student Manual

Instructor Material

Copy of all the above listed student materials
Copy of your school's operating policy, operating schedules and administrative details such as phone numbers to call when sick, etc.
Articles and other handouts from trade magazines, industry and government sources that give background information on the trucking industry and illustrate the need for professional drivers

Content

Activity or Topic	Approximate Time
1. BACKGROUND OF THE TRUCKING INDUSTRY	15 minutes
2. CURRICULUM OVERVIEW	45 minutes
3. SCHOOL POLICY AND REGULATIONS	45 minutes
4. STUDENT EVALUATION	15 minutes
	2 hours

1. BACKGROUND OF THE TRUCKING INDUSTRY (15 minutes)

Visual 1 Trucking Industry Background

Vital Part of Nation's Economy

Industry, commerce, lives of consumers depend on trucking industry
Tractor-trailers and other trucks haul
    Agricultural products to processing plants
    Food and other goods to supermarkets
    Raw materials (iron, coal, etc.) and machinery to plants
    Fuel from oil fields to refineries to gas stations and homes
    Completed goods (automobiles, TV's, etc.) to retailers
    Furniture and goods of families and offices around the country
Without safe and efficient services of trucking industry, our commerce and industry would not survive

Major Transportation Mode for Commerce and Industry

Close to 4 million tractor-trailer combinations on the road
Trucking industry hauls more goods than rail, air or water transportation
Takes over at points where rail, air or water transportation leave off
Hauls three out of four tons of all goods
Handles over 300 billion ton-miles each year
  One ton-mile equals one ton of freight carried 1 mile

Visual 2 Regulation of Trucking Industry

A Regulated Industry

Industry is subject to government regulation to ensure safety of industry and public

Two Major Types of Trucking

    Intrastate--hauls within a State
    Interstate--hauls between States

  Regulation of Interstate Operations

      Interstate Commerce Commission (ICC)
          Regulates economy of industry
          Gives operating rights to carriers, e.g., what and where they haul
          Department of Transportation (DOT)
          Major goal is to protect safety of public and industry
          Regulates through Federal Motor Carrier Safety Regulations (FMCSR)

EXAMPLE: Sets basic physical, knowledge qualifications of drivers
Establishes basic safety rules for drivers, e.g., limits number of hours that interstate driver can operate in day or week
Sets safety standards for vehicles, e.g., identifies required equipment, sets minimum standards for equipment, requires daily inspection by operator to ensure safe operating vehicle, etc.

State Regulations

Goal is to protect State citizens and State records
Issues licenses to drivers
Collects road and fuel taxes to help pay for costs of State roads
Limits length, width and weight of vehicles to protect roads, public

Importance to Students

Part of being a professional driver is knowing that complying with regulations that effect industry and its drivers
Students must learn about and comply with key regulations and make them part of their work habits

A Major Employer

Trucking industry is major employer in this Nation
- Employs about 8,000,000 persons
- Driver is key employee
- Need exists for professional drivers

Visual 3 Professional Driver

Definition of Professional Driver

Physically and Mentally Qualified

Meets minimum standards set by government and industry
Keeps him/her self in good physical/mental health at all times

Skilled

Qualified by training and experience to safely operate specific type of vehicles, e.g., tractor-trailer without damage to vehicle
Load and unload cargo safely and efficiently

Safe

- Understands and practices safe driving practices and follows all laws related to safe driving
- Far more knowledgable and a safer driver than the "average" driver
- Is expected not to get into accidents or cause accidents

Efficient

- Can haul goods to destination
  - On time
  - Industry can't operate successfully unless it meets schedules
  - Operate within the applicable regulations

Knowledgeable

- Knows government regulations, industry requirements related to driving and cargo handling duties

Fuel Economical

- Can drive without wasting fuel
- Important requirement today because of high fuel costs

A Good Representative of the Industry

- Truckers represent their company and industry to
  - General public
  - Customers
- To be able to drive well is not enough by itself to make a professional driver
- A professional driver is one whom in the eyes of the public is expected to perform better in any given situation than an automobile driver.

Training is the First Step

This training is first step to becoming professional driver.
Learning to be a professional driver is lifetime process.
It begins with the basic training in this course.

2. CURRICULUM OVERVIEW (45 minutes)

Visual 4 Types of Lessons

Four Basic Lesson Types in Curriculum

Classroom Instruction

- Students instructed by qualified instructor using
  - Lecture
  - Visual aids

Class discussion
Exercises

Purpose--To gain knowledge and background prior to practice driving or to gain background on subjects which must be more fully learned on the job.

Lab Instruction

Learning activities which take place outside of the classroom on or around a tractor-trailer

EXAMPLES: Vehicle inspections
Loading and securing cargo on trailer
Field trips and visits to local trucking companies

Range Instruction

Practice driving maneuvers in controlled situation offstreet area, under the guidance of an instructor

- Basic maneuvers practices include starting, stopping, turning, shifting, and backing
- Advanced maneuvers incude emergency stops and turns, offroad recovery, and skid recovery
- When not practicing, will observe and help other students
- Must develop basic skills on range before starting onstreet lessons

Onstreet Instruction

Practice driving in traffic situations under guidance of an instructor
Will proceed from light to medium to heavy traffic situations
When not behind the wheel will observe/critique other student drivers in order to learn from errors of others

Importance of Range/Street Activities

Only way to learn to operate vehicle is to get behind the wheel with guidance from qualified instructor.
Classroom and reading important only to prepare via knowledge, discussion and examples for range/street activities.

Over 70 percent of the course takes place in Lab, Range and Street lessons.

Key Student Materials

Student Manual

Lists objectives and outlines topics and activities for entire curriculum.
Helps student know what is coming in advance and what he/she should be learning.

Helps student find out if he/she is learning what he/she should be learning.

Federal Motor Carrier Safety Regulations (FMCSR)

Contains all rules and regulations interstate drivers must know and comply with

Will be studied and referred to throughout curriculum

Students responsible for learning information in FMCSR applicable to drivers as well as learning and demonstrating that they can drive tractor-trailer safely and efficiently

Curriculum Content

NOTE: Refer students to their copy of the course outline, Unit 1.1 of their Student Manual to follow along as you discuss curriculum content.

Visual 5 Section 1 - Basic Operation

Section 1 - Basic Operation

Purpose

To introduce students to curriculum components of tractor-trailer, and basic maneuvers

At end of section, students will have acquired the skill and knowledge to operate a tractor-trailer combination well enough to begin driving onstreet

Unit 1.1 Orientation

Introduces student to course content and vehicle via classroom lecture

Instructor points out key components of tractor-trailer in a lab demonstration

Unit 1.2 Control Systems

Introduces students to function, operation and meaning of instruments and controls, e.g., gear shift, tachometer, etc.

Instructor points out controls, instruments and their operation during a lab demonstration

Unit 1.3 Vehicle Inspections

Detailed classroom instruction on how to inspect tractor-trailer before operating, while in operation and at the end of a trip

Instructor will demonstrate pretrip inspection in a lab session

Students will practice and continue practicing throughout course

Unit 1.4 Basic Control

Students introduced to basic vehicle operation and concepts in class

Instructor demonstrates starting, stopping and backing on range, with students each taking turns at controls of a tractor-trailer

Students gain initial practice in basic control on range

Unit 1.5 Shifting

Students introduced to basic gear shifting procedures and shift patterns for most common tractor transmissions in classroom

Instructor demonstrates gear shifting technique on the driving range

Students practice shifting up through the first three gears

Unit 1.6 Backing

Students introduced to methods and concepts of backing a tractor-trailer in classroom

Instructor demonstrates and students practice variety of backing exercises on range

Unit 1.7 Coupling and Uncoupling

Students introduced to procedures for safely coupling and uncoupling a tractor-trailer in classroom

Instructor demonstrates coupling/uncoupling procedure on range and students begin practice under supervised conditions

Will develop proficiency throughout course by performing activity before and after street lessons

Unit 1.8 Proficiency Development: Basic Control

All skills learned in Units 1.2 - 1.6 practiced

A series of basic exercises are practiced on the range until students develop sufficient proficiency to drive onstreet

Initial onstreet practice occurs after sufficient student proficiency is developed on range

Unit 1.9 Special Rigs

Handling and operational characteristics of vehicles which students are not trained on are discussed in class, e.g., tankers, refrigerated vehicles

Field trip (optional) taken to observe special rigs and special rigs observed during all onstreet practice

Visual 6 Section 2 Safe Operating Practices

Section 2 - Safe Operating Practices

Purpose

To allow students to learn and practice for safe operation techniques in highway traffic

Unit 2.1 Visual Search

Classroom instruction on the principles of visual search

Range instruction on the use of mirrors

Onstreet practice in use of visual search techniques

Unit 2.2 Communication

Classroom instruction on communication, e.g., signaling, use of horn, etc.

Onstreet practice in communications techniques in variety of settings

Unit 2.3 Speed Management

Classroom instruction on speed management principles,e.g., maintaining safe speed in variety of situations, operating on hills, curves, etc.

Speed management demonstration in a lab session

Unit 2.4 Space Management

Classroom instruction on principles of managing space in traffic, e.g., following distances, space to the sides and rear, passing, etc.

Onstreet driving practice in space management techniques

Unit 2.5 Night Operation

Classroom instruction on inspection, preparation for, hazards of, and actual operations at night

Range practice inspecting vehicle at night

Onstreet lessons requiring application of night driving principles

Unit 2.6 Extreme Driving Conditions

Classroom instruction on driving in cold and hot weather, stormy conditions, mountainous terrains

Practice in putting on tire chains and towing a stuck vehicle

Unit 2.7 Proficiency Development: Safe Operating Procedures

All safe driving practices from Units 2.1 through 2.5 (and 2.6 if applicable) practiced as students develop proficiency

Each student drives in a variety of traffic conditions to develop proficiency

Visual 7 Section 3 Advanced Operating Practices

Section 3 - Advanced Operating Practices

Purpose

To enable students to acquire the advanced skills needed to handle hazards and emergencies

Unit 3.1 Hazard Perception

Classroom instruction and exercises in recognizing hazards early enough to prevent them from becoming emergencies

Onstreet driving sessions involving application of hazard recognition principles

Unit 3.2 Emergency Maneuvers

Classroom discussion of emergency braking techniques, evasive actions and responses to other emergencies

Emergency stopping and evasive actions practiced on range

Unit 3.3 Skid Control and Recovery
- Classroom instruction on causes of skidding and jackknifing and the proper techniques for avoiding and recovering from skids, jackknifes
- Student practice of skid prevention and recovery in skid pan exercises

Visual 8 Section 4 Vehicle Maintenance

Section 4 - Vehicle Maintenance

Purpose

To prepare students to recognize causes of vehicle malfunctions and to perform basic maintenance and simple emergency type of repairs

Unit 4.1 Vehicle Systems
- Classroom instruction on function and operation of all key vehicle systems, e.g., engine, engine auxiliary systems, brakes, drive train, coupling systems, suspension, etc.
- Instructor gives detailed description of each system, its importance to safe and efficient operation and what is needed to keep it in good operating condition

Unit 4.2 Preventive Maintenance and Servicing
- Supervised student practice in vehicle servicing, including checking engine fluids, changing fuses, checking tire inflation, changing tires, draining air tanks, adjusting brakes, and performing repairs

Unit 4.3 Diagnosing and Reporting Malfunctions
- Classroom instruction on identification of vehicle malfunctions and problem solving exercises
- Lab demonstration of proper emergency starting procedures

Visual 9 Section 5 Nonvehicle Activities

Section 5 - Nonvehicle Activities

Purpose

To enable students to carry out those nondriving activities that professional drivers must perform

Unit 5.1 Handling Cargo
- Basic principles of loading and unloading cargo, including weight distribution and techniques for securing and covering cargo
- Practice loading a vehicle under instructor's supervision
- Visit to local freight handling company to observe operations (optional)

Unit 5.2 Cargo Documentation

Discussion of basic forms and procedures required when driver handles cargo, e.g., bills of lading and other freight documentation

Basic procedures and responsibilities for placarding vehicles that carry hazardous materials

Unit 5.3 Hours of Service Requirements

Classroom instruction in permissible hours of duty, rest periods, etc.

Introduction and practice using Driver's Daily Log Book to record time.

Use of log book to record school activities for remainder of course

Unit 5.4 Accident Procedures

Basic instructions for handling the scene of an accident, reporting accidents, rules and regulations related to accidents

Introduction to basic first aid practices (optional)

Introduction to use of fire extinguishers and basic fire-fighting techniques, especially those related to truckers, e.g., tire fires

Lab demonstration in use of fire extinguishers

Unit 5.5 Personal Health and Safety

Physical requirements for driving a vehicle in interstate commerce, medical examination and certification

Discussion of basic health maintenance requirement, diet, exercise, use of alcohol, drugs and avoidance of fatigue

Discussion of common nondriving safety hazards and use of special equipment, e.g., gloves, hard hats, goggles, and equipment used with hazardous material

Unit 5.6 Trip Planning

Class discussion of importance of and requirements for planning trips

Federal and State requirements including need for permits, vehicles size and weight limitations, etc.

Classroom exercise in which students plan an overnight trip with school vehicle, including identification of permits, estimating time of arrival, fuel stops, etc.

Unit 5.7 Public Relations and Employer Relations

Classroom instruction and discussion on maintaining a good image, public relations problems of trucking industry, dealing with public and customers

Classroom instruction and discussion of relationship to employer including how to look for a job, get a job, and keep a job

Student practice interviewing for a job

Guest lecturer from trucking industry (optional)

NOTE: Distribute actual copies of your school's course schedules to students. Discuss and answer questions related to scheduling and prerequisites for various units.

3. SCHOOL POLICY AND REGULATIONS (45 minutes)

NOTE: School administrators and instructors should jointly develop this information based upon school size, type of operations and so on, to meet your actual requirements. Below is a suggested format which you may wish to modify for your own use.

Introduction of School Staff

Identify classroom, range and road instructors
Give brief outline of past experience of each as they are introduced

Issue Name Tags to Students

Use this as a form of student introduction and ask students to wear tags at all times to aid the instructors

Give a Brief Description

Physical layout of school, offices, shop, driving range, student parking areas, etc.
Housing, eating, and restroom facilities
Communications, how to report illness, who to call when tardy or absent, how to report an injury or accident

Student Conduct and Safety Rules

Visual 10 Student Rules

NOTE: Refer students to "Student Rules" in Unit 1.1 of Student Manual.

We expect all rules to be followed to the letter. Our basic rules are just like the ones you would find in any other specialized school for adults.

Training begins promptly at the designated starting time. You have to be on time, and you have to be here every day. If you're tardy it will show up on your record and will not look good to someone interested in hiring you. Also, just a few minutes missed can cost you valuable training.

No horseplay will be permitted among students or instructors. While it may seem harmless enough, it can lead to ill feelings. Also someone could get hurt or some equipment destroyed or damaged.

Abuse of equipment will not be tolerated under any circumstances. It is especially easy to use equipment roughly when you become frustrated, and you may become frustrated when you can't accomplish a maneuver the way your would like to do it. So, when the trailer won't go where you want it, don't blow up and "take it out" on your vehicle. Remember that it is not your truck's fault. Get out of your vehicle, let someone else try for a while. Watch how he/she has trouble too, try to get relaxed before you try again.

Alcohol and drugs of any kind are totally prohibited anywhere in trucking. Any signs of alcohol or drugs about you will be the cause for immediate dismissal from school. Your off-duty time is your own, but even when you are off duty, you should remember that you have to be in A-1 condition the next day when you come back to school, and alcohol and drugs don't help to make you ready to go the next day. As a suggestion, it might be a good idea to use some of your off-duty time to review what you have learned and to study for the following day.

Profanity should not be used. Many people use profanity in general conversation without realizing it. Some people use it when they are upset or when they want to feel 'big'. But, profanity offends many people, and really does no one any good. Don't use it for any reason.

Grounds keeping is always a big job and every one has to cooperate to keep the whole school clean. Put all trash in containers. Cigarette packs and snack wrappers and so forth are small, and many people think that one little piece of paper won't show very much, but, with as many people as we have here everyday, just a little littering from each one can mount up to a trashy operation, and nobody wants to work in less than a first class place. If you can't immediately find a container, put pieces of trash in your pocket until you can dispose of them properly. Absolutely never throw anything out of the trucks. Not only does it make truck drivers look bad, but it may frighten a passing motorist or hit a pedestrian.

Soft drink bottles are a hazard and must be kept out of the working area. Don't take them on to the training field. Never place an empty bottle in the cab of the truck. It could roll under your brake pedal and may cause an accident. Put all bottles back in the proper containers.

There will be no smoking in any truck, either while driving, or observing, and no smoking around refueling areas.

Sometimes, when you are an observer, you will be riding in a nonmodified sleeper berth. Your shoes must be removed and placed under the right hand seat. Wear shoes that are easy to get on and off when you are driving. Generally, as an observer, you will be seated in the area where the sleeper berth has been removed. Regardless of whether you are in a berth or on a seat, seat belts must be fastened anytime and everytime that you are in the truck, even in practice around the exercise yard. Instructors will enforce this vigorously, as will your employers.

You must stay on the truck or problem you are assigned to; no visiting another student, or wandering away from your assignment.

You will find some specific safety rules for both Range Driving and Street Driving in Unit 1.1 of your Student Manual. These must be observed at all times, both for your own and the safety of others.

We work in any kind of weather, rain, shine, sleet, snow and so forth, and weather conditions don't affect our schedule unless roads are closed - and this seldom happens. If you don't already have it, rain gear is suggested. You can get plastic rain suits that do the job pretty well from most any department store. Also, be advised that we work some of our problems at night and we sometimes start before dawn to give your experience in facing the sun. Many truckers work at night, so we believe you should learn how your driving job looks after dark, how it is more difficult to drive at daybreak and sunset, etc. Therefore you must be prepared to work at some odd hours. Plan your rest and sleep according to the schedule you have coming up. Don't let your recreational time get you into a situation when you don't have enough sleep to be in good shape to learn.

If you do not presently have a good pair of sunglasses, get some and keep them with you at all times during school.

Wear your gloves when you are working around the truck. Your hands will be kept clean and also reduces chance of injury. Remove your gloves when you enter the cab so that you don't get grease on the controls.

Park your cars only in the designated student parking area and keep them out of the exercise area. (Explain your school's regulations on parking).

Everyone must be in the classroom at the end of his training period for dismissal. As soon as you are released from your truck, go to your designated classroom. Do not leave the school for any reason unless cleared with the proper school authorities. (Designate the chain of command).

You must follow school instructions without deviation. If you have driven a truck before, "park it outside the school" and forget it; things you thought you knew all about before, could hinder your training now. You are always free to ask questions and to discuss the reasons behind any instructions given by the school but, after discussion, do what the instructor requests.

Don't argue with an instructor for any reason; remember, they have a tough job and everything they say or do is for your benefit. Work with them. They often know you and your problem better than you know yourself. Also, they have a reason for doing things as they do. Make sure you know the difference between asking questions or having a discussion for information (both of which are encouraged) and having an argument (which is childish).

You must keep a positive attitude and an open and receptive mind at all times; this course is tough, and anything other than a positive attitude will hold you back. If you are convinced that truck driving is easy, you have been misled. Truck driving is a hard, sometimes dirty job. This means that you've got a rough road to travel for the duration of this training program. You will only benefit from it if you bear down, put your mind to it, and pull together with your instructors and with your fellow students.

As is the case with any school, we have established standards that you have to meet. You will be given a final examination on each training subject, with most emphasis being put on the road test and the backing skills. You will also have to be proficient in coupling and uncoupling of units, pretrip inspection, logging procedures and D.O.T. regulations. We test your skills but we also measure your attitude, your ability to think, and your judgment.

If you do not meet the minimum standards set by the school, you will not graduate. When we graduate a driver, that driver has mastered this course. This means that everything about that driver has to be right enough that we think he can control the truck and himself or herself well enough to reflect credit on their employer, this school, and the individual as a human being entrusted with substantial responsibility in a public position. This does not mean that we are trying to scare you or discourage you; if you put your fullest concentration on learning, if you follow instructions, and if you have all that is needed to be a truck driver, you will pass our test, graduate and be ready for employment.

You know, and we know, however, that some people just cannot make good drivers. We have had some students in the past who could not be trained as a truck driver; there may possibly be some here. We will work with, and do anything possible to help a student with a learning problem. But, if we do not feel that you are trainable, or if we cannot get you to give up unsafe practices, or if you don't show us the correct attitude, judgment, or maturity, you will be dismissed from the school.

Much of our driving is done on the public highways. This means that you must possess good driving ability and habits before we will let that part of your training start. All laws must be obeyed at all times, and sound, defensive driving is the only way to go. Remember, a professional truck driver is a professional - not a kid.

Starting with the first minute of training, you will be expected to maneuver your vehicle through close quarters in the yard without touching anything - whether it be a barrel or a traffic cone. You must watch all around the truck, and if you are too close to anything, you must stop and correct your error. If you hit any object, it is because you were not looking, or because you were careless. Be extra careful. There will be a field full of student drivers out there. Watch out for pedestrians and, when you are a pedestrian yourself, look out for the trucks.

You will be assigned to a regular class and classroom. You must report on time each day for roll call. At that time, we will review our schedule for the day and assign trucks. Any change of student groups or of instructors will be announced. Each day, additional information and instruction will be given. This means that you must always be present.

This class will be broken into groups for training. (Specify number of groups.) This gives us maximum use of the equipment and assures equal training for all. Whatever Group 1 does one day, Group 2 will do the next day. Each group will be broken down into teams of three persons each and the teams will train together as a group.

It is important that you work together and help each other in any way possible. Every item involved in our training will be explained fully, and then practiced. We have got a lot to cover in the training period, so we must insist on your complete cooperation.

I will not wish you luck, because luck has nothing to do with truck driving. Truck driving takes skill, judgment, maturity, and knowledge. These capabilities can only be acquired through effort, effort, effort.

Some Tips on How to Study

NOTE: Refer students to "Some Tips on How to Study" in Unit 1.1 of Student Manual.

The following are some tips that can help you in your learning, particularly in the bookwork as opposed to range and road work.

a. First is Best and Longest Remembered

That which you learn first you learn best and remember the longest. You should always review and rewrite your notes if at all possible.

b. Motivation

The main thing that keeps many students from developing effective study habits is lack of motivation. Many students who want to do well cannot bring themselves to study when they should, and even when they do settle down to study, they cannot really concentrate on the job. There is no real remedy for this, but there is a method that will make studying more pleasant. The method is as follows:

1) Know exactly what you want to get from your studies. Why are you here?

2) Be really interested in what you are doing. No one can be interested for you. Are you really interested in learning to drive a truck?

3) You will be motivated when you know what you are expected to learn and when you have a strong desire to learn it.

c. Physical Environment

Besides motivation, what many students lack is a routine for study. This means that the physical environment is a very important part of the study routine. Remember that you have chosen a certain area for study and that you really mean to do nothing there but study. You must, therefore, free that area of distractions. This means you must be sure that you are studying instead of

1) Talking with your buddies

2) Making telephone calls

3) Being distracted by TV or radio

You can sum it up by saying that you must surround yourself with a wall if you are to study properly.

d. Study Methods

There are general rules for the effective study of books and lessons. People who are good at studying make use of these rules in one way or another whether they know it or not. These people will differ in their general style of learning and in the way they depend on different rules, but they do follow certain rules.

One way of phrasing the rules for effective study has been worked out at Ohio State University. According to this study, the essential rules are condensed into a formula: SURVEY Q 3R or merely SQ3R. This means:

SURVEY
QUESTION
READ
RECITE
REVIEW

1) SURVEY

Survey what you are going to read by glancing through the material, and running through the various chapter headings. In this way, you learn, in general way, what the chapter is about, and you know what to expect. It is also a good idea to read the introduction. This will let you know where you are going. You should also read the summary, if there is one. This will give you the main ideas or important points. When you know where you are going, you become motivated and oriented.

2) QUESTION

Ask yourself, "What am I expected to learn?" It is also valuable to ask your own questions about the learning material. Try to turn the headings to sections into questions, and read for the answers. This makes you concentrate by giving you something to look for. Questions, then, have several benefits; they maintain interest, make you participate actively, and cause you to test yourself to see what you are learning. If you test yourself before your instructor does, you will do much better.

3) READ

The next, step, of course, is to read and to read carefully, read to answer the questions you must ask yourself, and continually challenge yourself to see that you understand. Read to remember, and read everything; that means tables, graphs, and other illustrations. These often emphasize important points and can tell you at a glance what the whole page is about. But, reading like this means taking notes or making an outline.

4) RECITE

This is one of the most important techniques of effective study. To make sure that you understand and remember, stop periodically and recite to yourself what you have read. After reading a paragraph, topic, or chapter, stop reading, and in your own words, answer the questions that you asked yourself about the subject. This step is where most learning takes place.

5) REVIEW

Enforce your learning by frequent review. If you learn something perfectly but do not review it, you will find that a few days, or even a few hours, later you will remember only a small part of it. FORGETTING TAKES PLACE VERY RAPIDLY.

Remember, no one can study for you. It is your responsibility. The most important problem in studying effectively is development of motivation to study, and only you can supply this. But, organized study routines are helpful, especially when helped through SQ3R.

4. STUDENT EVALUATION (15 minutes)

NOTE: Refer students to "Evaluation Procedures" in Unit 1.1 of Student Manual.

Visual 11 Evaluation Procedures

Evaluation Procedures

Students evaluated periodically throughout course
- To measure progress towards midcourse and final course standards
- To identify need for remedial training
- To identify mastery of each unit in curriculum

Progress evaluation
- Written test at end of each section to measure mastery of unit objectives
- Instructor appraisal of student progress during all lessons

Midcourse evaluation

- Must pass midcourse proficiency range test to continue course (after completion of Unit 1.8)
- Students will perform series of maneuvers and performance will be measured by objective standards
- Exercises include
  - Maneuvers
    - Backing maneuvers, e.g., parallel parking, alley dock, etc.
    - Serpentine maneuvers, e.g., ability to take turns, curves forward and backward
  - Controlled Stop
  - Overhead Clearance Judgment
  - Coupling and uncoupling
  - Pretrip inspection

Final Examination

- Administered following completion of entire course
  - Final examination includes
    - Written test--Which samples all information learned in five sections
    - Range test--Same as midcourse, but higher scores required
    - Street test--A driving test to demonstrate ability to safely handle vehicle under variety of road and traffic conditions

Must pass final examination in order to graduate from course

Question and Answer Period

Present and discuss specific evaluation procedures used by your school, e.g., weekly conferences with students, remedial training and homework, repeat of units, etc.

Answer student questions relating to evaluation of their performance and progress in course.

Visual 1

The American Trucking Industry

- Vital Part of Nation's Economy
- Close to 4 Million Tractor-Trailer Combinations on the Road
- Hauls 3 Out of 4 Tons of All Goods
- Handles Over 300 Billion Ton-Miles Each Year

Visual 2

Regulation of Trucking Industry

- Interstate Commerce Commission–Regulates the Operation of Interstate Motor Carriers

- U.S. Department of Transportation–Regulates Safety of Interstate Motor Carriers

- The States Issue Regulations Covering–
  - Chauffeurs Licenses
  - Registration of Trucks
  - Vehicle Size and Weights
  - Collects Taxes

Visual 3

Professional Driver

Physically and Mentally Qualified

Skilled

Safe

Efficient

Knowledgeable

Fuel Economical

Good Industry Representative

Visual 4

Types of Lessons

Classroom

Lab

Range

Onstreet

Visual 5

Section 1–Basic Operation

1.1 Orientation

1.2 Control Systems

1.3 Vehicle Inspection

1.4 Basic Control

1.5 Shifting

1.6 Backing

1.7 Coupling and Uncoupling

1.8 Proficiency Development: Basic Control

1.9 Special Rigs

Visual 6

Section 2—Safe Operating Practices

2.1 Visual Search

2.2 Communication

2.3 Speed Management

2.4 Space Management

2.5 Night Operation

2.6 Extreme Driving Conditions

2.7 Proficiency Development: Safe Operating Procedures

Visual 7

Section 3–Advanced Operating Practices

3.1 Hazard Perception

3.2 Emergency Maneuvers

3.3 Skid Control and Recovery

Section 4–Vehicle Maintenance

4.1 Vehicle Systems

4.2 Preventive Maintenance and Servicing

4.3 Diagnosing and Reporting Malfunctions

Section 5–Nonvehicle Activities

5.1 Handling Cargo

5.2 Cargo Documentation

5.3 Hours of Service Requirements

5.4 Accident Procedures

5.5 Personal Health and Safety

5.6 Trip Planning

5.7 Public Relations and Employer Relations

Visual 10

Student Rules

1. Must Be on Time
2. No Horseplay or Practical Jokes
3. No Abuse of Equipment
4. No Use of Alcohol or Drugs
5. No Profanity
6. Keep Grounds and Equipment Clean
7. No Drink Bottles or Cans Except in Authorized Areas, Put in Trash Containers
8. No Smoking on Trucks or Around Fuel Pumps
9. Shoes Off in Sleeper
10. Seat Belts Must Always Be Worn
11. Stay With Truck or Problem as Assigned
12. Park Cars Only in Designated Student Parking Area
13. Be in Classroom Every Day for Dismissal, Unless Excused
14. Follow Instructions Without Deviation or Ask for Permission
15. No Arguing With Instructor for Any Reason
16. Keep Positive Attitude With Open and Receptive Mind

Classroom Procedures:

1. Report to Classroom as Assigned Each Day for Roll Call
2. Review Schedule for the Day
3. Speak Only When Called on
4. No Noise or Disturbances

Evaluation Procedures

- Progress Evaluation
  - Written Test
  - Instructor Appraisal
- Midcourse Evaluation
  - Maneuvers
  - Coupling and Uncoupling
  - Pretrip Inspection
- Final Examination
  - Written Test
  - Range Test
  - Road Test in Traffic

LESSON 2 INTRODUCTION TO THE TRACTOR-TRAILER (CLASSROOM)

Overview

Time Allotted: 1 hour 15 minutes

Prerequisites: None

Purpose:

The purpose of this lesson is to present a simplified picture of tractor and trailer design and of key vehicle systems and parts. Where possible, relate your brief explanations to what students already know about automobiles. Beginning in this lesson, students should start to gain the mechanical knowledge they need to operate vehicles safely and legally. This knowledge will grow as the course progresses. But keep in mind that you are training drivers, not mechanics.

NOTE: Keep in mind that the purpose of this lesson is the basic familiarization with the subject. Hence the relatively short periods of time allocated. Questions should be held to a minimum until Lesson 3, when they take a "guided tour" of a tractor and trailer.

Materials

Instructional Aids

Visuals 1 - 29

Student Material

Review Quiz, in Unit 1.1 of Student Manual

Instructor Material

Review Quiz, in Unit 1.1 of the Student Manual
Operator's and/or Services Manuals for your school's training vehicles

Content

Activity or Topic	Approximate Time
1. VEHICLE DEFINITION, CAB DESIGN, AND AXLE ARRANGEMENTS	10 minutes
2. DESIGNING A TRACTOR FROM FRAME TO FINISHED PRODUCT	20 minutes
3. SEMI-TRAILERS AND FULL TRAILERS	5 minutes
4. ENGINE AUXILIARY SYSTEMS	10 minutes
5. THE AIR BRAKING SYSTEM	10 minutes
6. REVIEW QUIZ	15 minutes
7. LAB PREPARATION	5 minutes
	1 hour 15 minutes

1. VEHICLE DEFINITION, CAB DESIGN, AND AXLE ARRANGEMENTS
(10 minutes)

Visual 1 Straight Truck and Truck Tractor

Definition and Major Parts of a Truck Tractor

Categories

Straight trucks have cab and cargo body on single chassis
Truck tractors designed to pull other vehicles which carry cargo

Parts

Chassis--contains all the parts except body and cab
Body--carries the cargo
Cab--driver's compartment

Visual 2 Conventional Cab Design

Basic Cab Designs

Most truck tractors fall into two categories:
- Conventional cabs
- Cab-over-engine (COE) designs

Conventional Cab Design

Cab placement and engine access are "conventional" like a car
Cab sits behind engine
Engine accessed by raising or opening the hood

Visual 3 COE with a Sleeper Berth

Cab-Over-Engine (COE) Design

Cab placement and is over the engine
- Engine accessed by tilting cab forward
- Restrictions on overall length prompted design

Sleeper Berth

Sleeper berth behind driver
Available in both COE and conventional type cabs
Team driving: One driver sleeps while other drives

Visual 4 Other Cab Designs: Low Cab Forward, Halfcabs, Short Nose Conventional

Other Cab Designs

Location of cab obvious in title

Low Cab Forward (Driver sits down in front of engine)

Tilts for engine access

Halfcab (Driver sits beside engine)

Usually found on combination on-off road rigs, i.e., jockey tractors, cement mixers
Short Nose Conventional (Driver sits behind engine)
Engine protrudes back into cab

Visual 5 Single-Axle Truck Tractor

Basic Tractor Axle Characteristics

Function

Front axle is the steering axle
Rear axle(s) are power or drive axles

Terms
"Live" axles have power transmitted to them
"Dead" axles do not have power transmitted to them.

Shorthand--Tractors can be described by number of live versus dead wheels

Number of Axles--primarily determined by weight to be pulled.

EXAMPLE: "4 X 2" tractor (as in the Visual)
First number--Total number of wheels (Duals counted as one)
Second number--Number of "live" wheels

Single Axle Tractor

One rear axle with dual wheels
Obviously has 2 axles but is commonly called a "single-axle tractor"
Could be either gasoline or diesel powered

Visual 6 Tandem Axle Truck Tractor

Tandem Axles

Tandem means 2 axles working together
Obviously has 3 axles but is commonly called a "tandem axle tractor"
Rear tandem axles--Many over-the-road trucks
Front tandem axles--Some heavy-duty trucks

Tandem Tag Axle

- Combination of live and dead axles
- Forward axle is live.
- Rear axle is dead ("tags" behind the driven axle)
- Dead axles sometimes retractable (liftable)
  - When not pulling load
  - Saves wear on tires
- Commonly called a "tag axle tractor"

Tandem pusher axle

Also combination of live and dead axle
Forward axle is dead
Rear axle is live ("pushes" forward axle along)
Dead axles sometimes retractable
Commonly called a "pusher tractor"

Tandem Driven Axle

- Both axles live
- Have best traction, pull heaviest loads
- Many heavy duty, over-the-road tractors
- Commonly called a "twin screw tractor"

2. DESIGNING A TRACTOR FROM FRAME TO FINISHED PRODUCT (20 minutes)

Design Factors

Designed Piece by Piece for Specific Hauling Purposes

- Cab design and axle arrangement most recognizable design features
- Other key components selected and designed for specific purposes

Design Depends Upon Several Factors

- Where it will go, e.g., terrain, rural vs. urban
- Job it will do, e.g., stop-and-go vs. long haul
- Size and type of payload it has to pull
- Regulations restricting size

Visual 7 Frame: Key Components

Frame

Basic foundation of chassis

Key Parts

- Left and right side frame rails
- Cross members connecting frame rails

Connected Directly or Indirectly to All Parts of Truck

- Engine mount
- Cab support
- Fuel tank support

Visual 8 Gasoline vs. Diesel Engine

Engine

- Power plant of tractor
- Gasoline or diesel a few use liquified petroleum gas (LPG)
- Most modern truck tractors use diesel engines that are
  - Internal combustion engine (like gasoline)
  - No carburetor or spark plugs (unlike gasoline)

Visual 9 Drive Train: Key Components

Drive Train

Clutch

- Transmits power from engine to transmission on drivers command

Transmission

- Transmits power from the engine to drive axle(s)
  - Uses gears to increase or decrease power and/or speed to the axles

- Three major types of transmissions:
  - Manual
  - Semiautomatic
  - Fully automatic

Manual

- Most common
- All gear changes made by driver

- Key parts
  - Gearshift operates transmission
  - Clutch used to interrupt engine power to transmission to allow gear changes

- Two transmissions
  - Used on trucks that pull very heavy loads in on-off road situations
  - Main transmission
  - Auxiliary transmission (aux box)
    - Supplies additional power for heavy loads
    - Operated with two gearshift levers

Semiautomatic

- No clutch, just gear shift
- All gear changes still made by driver

Fully Automatic

- No gearshift or clutch, just lever to select range

Driver selects range (i.e., 1-3, 1-5, 1-7)
Transmission automatically performs all shifting within the range selected by driver

Drive Shaft

Transfers power from transmission to rear axle
Universal joints keep shaft in alignment with rear axle over uneven surfaces

Rear Axle Components

Interaxle differential
    Used with tandem axles
    Divides power between axles
    Allows each axle to turn at different speed

Rear axle assembly
    Final drive gears operate the axle
    Axle differential allows wheels at each end of axle to turn at different speed when cornering

Multispeed ratio rear axles
    Two or three speeds in final drive gears
    Manually operated by driver in the cab according to need

Visual 10 Suspension: Key Components

Suspension System

- Attaches axles to frame
- Flexible, shock absorbing
- Variety of systems available
    - Steel spring
    - Hydraulic shock
    - Air bellows
- Additional components
    - Torque bar for stability
    - Auxiliary or helper springs for extra heavy load

Visual 11 Steering System: Key Components

Steering System

Steering principles same as car

Front axle is steering axle
    Provides direction; rear axle follows
    Attached to frame by suspension system

Key parts
    Steering knuckle
        At the end of each front axle
        Allows wheels to rotate

Spindle

- At the end of each steering knuckle
- Attached to wheel assembly
- Allows wheel assembly to rotate

Pitman arm and drag link

- Connection between steering wheel and steering knuckle
- Transfers motion from steering wheel to front wheels
- Connected through steering gear box

Visual 12 Wheels and Tires

Wheels and Tires

Wheels

Cast spoke wheels (Dayton)

- Two-piece construction
- Three, five, or six spokes
- Rims held on wheels by studs, clamps, and nuts at the end of each spoke

Disk wheel (Budd)

- One-piece construction
- Aluminum or tensile steel or aluminum to reduce weight

Tires

Both Tube and Tubeless Types used

Size: Popular size is 10:00 x 20:00; other sizes in use depending upon load requirements

Mounting:

- Important to mount tires properly on rims wheel
- Important not to mix styles, e.g., radials and nonradials on same axle

Important to match dual tires (same circumference)

Visual 13 COE in Tilted Position

Finished Tractor

EXAMPLE: COE in tilted position

Illustrates two more key tractor components

Cab Tilt Operation

Hinge operated mounting with mechanism to fasten rear of cab in place

Operated hydraulically or by hand

Safety brace to protect personnel under raised cab

Fifth Wheel

Connects trailer to tractor

Two halves
    Lower half on tractor
    Upper half on trailer

Kingpin connects the two halves
Lock prevents their separation

Visual 14 Types of Fifth Wheels

Types of Fifth Wheels on Tractor

Stationary

Fifth wheel bolted to frame

Manual Sliding

Mounted on rail unit
Move forward or backward by hand for axle weight distribution
Locked in place by steel pins

Power Sliding

Operates like manual sliding - using air pressure
Locks are controlled from inside the cab

3. SEMI-TRAILERS AND FULL TRAILERS (5 minutes)

Visual 15 Basic Trailer Types

Basic Trailer Design

Semi-trailers

Rear end rest on its own wheels
Front end rests on the tractor

Full Trailers

Has own wheels front and rear

Examples of Closed Trailers

Vans--carry furniture, dry freight
Refrigerated vans--carry perishables

Tankers--haul chemicals, fuel
Open top vans (canvas covered van trailers with full sides and rear doors)

Example of Open Trailers

Flat beds--haul steel, building products
Low boys--haul heavy machinery, earth moving equipment
Dump trailers--haul dirt, gravel

Trailer Length

Varies from 18 feet to more than 50 feet
Typical tractor-trailer is 50 feet to 65 feet in length

Visual 16 Semi-trailer: Key Components

Semi-trailer: Key Components

Kingpin

Mounted in the upper fifth wheel
Connects to lower fifth wheel
Allows tractor to turn under trailer
Tractor's rear axle becomes trailers steering axle

Landing Gear or Dollies

Lowered when uncoupled to support front of trailer
Raised when coupled

Axles

- Trailers may be equipped with 1, 2, or more axles
- Some axles may be retractable
- Some axles may be adjustable (moved forward or backward under the trailer frame)
  - Adjustable sliding rear tandems
  - Can be moved for weight distribution
  - Forward position
    - Relieves weight on tractor axles
    - Transfers weight from tractor drive axles to the trailer axles
  - Rear position
    - Puts more weight on trailer axles
    - Relieves weight from tractor drive axles
  - Held in position by steel locking pins

Visual 17 Full Trailer Couplings

Full Trailer Coupling

- Drawbar connects to tractor
  - Eye of drawbar attach to pintle hook
  - Safety chains used in case drawbar breaks

Visual 18 Converter Gear

Converting a Semi-trailer to a Full Trailer

Single-Axle Converter Gear

Removable gear to convert semi- to a "full" type of trailer
Called dollies
Has suspension spring, drawbar and fifth wheel

Tandem-Axle Converter Gear

Same as above but with 2 axles

4. ENGINE AUXILIARY SYSTEMS (10 minutes)

NOTE: Identify the key engine auxiliary systems and components. Diesel engine will be used as primary example since it is the power plant of most modern tractors. Distinguish parts that are specific to diesel from those common to both diesel and gasoline. Avoid in-depth discussion of these items here, as they will be covered in subsequent Units, this lesson is only meant to enable students to become familiar with vehicle nomenclature.

Engine Auxiliary Systems

Systems required for engine operation
Key components
- Fuel system
- Air intake system
- Superchargers and turbochargers
- Exhaust system
- Cooling system
- Lubrication system
- Electrical system

Visual 19 Fuel System: Key Components

The Fuel System

Stores and provides fuel for engine operation.

Operation and Key Parts

Fuel pump draws fuel from fuel tanks
    Filtered through fuel filters
    Travels through fuel lines to fuel injectors

        Nozzles of fuel injectors
        Spray fine mist into engine cylinders
        Operated by injector pump

Visual 20 Air Intake: Key Components

The Air Intake System

Provides huge volumes of clean, filtered air for diesel engine.

Function

- Collects the air
  - Snorkel or extension pipe collects air over cab
  - Bonnet or rain hat strains out debris

- Filters the air
  - Diesels need huge amounts of clean air to function
  - Air filters remove dust and dirt
  - Located under hood or outside cab

- Distributes the air
  - Air intake distributing manifold distributes air to cylinders
  - Received through air intake ports

Visual 21 Example of a Turbocharger

Superchargers and Turbochargers

Forces more air into engine cylinders than would otherwise occur.

Function

- Engines without superchargers or turbochargers are known as "naturally asperated" that is they "inhale" air normally

- Superchargers are simply an air pump, used to blow more air into the cylinders, hence they are nicknamed "blowers"

- Turbocharging is yet another method of supercharging, in which engine exhaust is used to power a turbine, which is utilized to push or blow more air into the cylinders

Advantages

- Creates additional power
- Better fuel economy
- More complete burning of fuel--less smoke

Visual 22 Exhaust System: Key Components

The Exhaust System

Expels exhaust gases from engine.

Operation and Key Parts

Collects engine exhaust in the exhaust manifold
Muffles engine exhaust noises to acceptable level with muffler
Discharges exhaust gases through a tailpipe or exhaust stack
    Rain cap protects exhaust stack from rain
    Closed when engine is off
    Forced open by exhaust gases

Visual 23 Cooling System: Key Components

The Cooling System

Removes excess heat from engine.

Operation and Key Parts

Operates in principle like automobile cooling systems
Coolant is stored in radiator
Circulated through engine water jackets by water pump and returned to radiator
Coolant temperature controlled by
    Thermostat--regulates flow of coolant through radiator
    Fan--Regulates flow of air through radiator
    Radiator shutters--controlled by thermostat to control amount of frontal air across radiator

Visual 24 Lubrication System: Key Components

The Lubrication System

Provides clean lubricating oil so engine parts operate without friction.

Operation and Key Parts

Oil supply is stored in oil pan
Oil pump forces oil through engine
Oil filters clean the oil.
Several different types of oil filters and filtration systems are available.
Diesels usually use both a primary and secondary filtering system

Visual 25 Electrical System: Key Components

The Electrical System

Purpose

To crank the engine (diesel engines do not have electrical ignition)
To operate electrical equipment: lights, instruments, radios, charge batteries
Electrical current supplied from tractor to the trailer by cord and plug

5. THE AIR BRAKING SYSTEM (10 minutes)

Brake Systems and Types of Brakes

Systems Required by Law

Service brakes for all non-emergency stops
Emergency brakes for emergency stops
Parking brakes to hold tractor when parked

Service Brakes

Operated by air
Sometimes in combination with hydraulic brakes
Foot treadle applies brakes to all wheels for normal stop
Independent trailer brake valve (nicknamed trolley valve) applies brakes to trailer wheels only used only in special situations

Emergency Brakes

Spring operated
Deactivated by air for normal driving
Applied automatically when air pressure falls

Parking Brake

Spring operated
Applied by hand

Visual 26 Tractor Air Braking System

Air Braking System for Service Brakes

Most used
Most complex

Compressed Air Storage

Air Compressor
- Provides compressed air
- Compressed air becomes hot
- Sent to wet tank first and then to dry tank

Wet Tank
- Receives compressed air from compressor
- Cools down compressed air
- Condenses and forms water pools
- Petcocks must be opened to drain excess moisture daily
- Some vehicles equipped with automatic moisture ejectors

Dry Tanks
- Receives air from wet tank
- Stores air prior to use

Air Compressor Governor
- Measures the amount of compressed air
- Prevents overfilling and damage to air reservoirs
- Vents excess air pressure when reservoirs are full

Air Pressure in the System
- Air brakes operated when there is sufficient air pressure
- Driver monitors for sufficient pressure via air pressure gauge
- Low air warning devices serve as a driver reminder (buzzers or flashing lights)

System Operation

Treadle Valve
- Like foot brake
- Pushed to release air from dry tank
- Air travels through air lines to brake chambers
- Converted to mechanical power to operate brakes on wheel

Trolley Valve
- Independent trailer brake valve releases air to trailer brakes only
- Some vehicles not equipped with trolley valves

Visual 27 Drum Brake: Key Components

Key Parts and Operation of Drum Brakes

- Pushing force in brake chamber operates the system
    - Compressed air pushes brake diaphragm which
    - Moves pushrod which
    - Moves slack adjuster which
    - Turns cam on brake camshaft which
    - Forces brake shoes against brake drum
    - Forces wheels to turn slower and slower which
    - Stops the vehicle

- Slack adjusters play key role
    - Controls distance a set of brake shoes must travel to contact the brake drum
    - System could fail if out of adjustment

Visual 28 Trailer Air Braking System

Trailer Air Brake Connections

Air pressure from the tractor is carried to trailer by a pair of flexible hoses - A service line and an emergency line

Service Lines
- Usually black, sometimes color-coded blue
- Maintains constant supply of air in the line

Emergency Lines

Usually black, sometimes color-coded red
Carry supply only when treadle valve is depressed

Glad Hands

Metal fixtures at the end of air lines
Connected to similar devices that are bolted to trailer
Clasped hand appearance gives the name

6. REVIEW QUIZ (15 minutes)

Complete the review quiz from the student material for Unit 1.1. Allow time for students to complete the quiz individually and then discuss as a group or use the quiz as a group review exercise and call on students randomly.

A copy of the review quiz follows.

Visual 29 Tractor-Trailer Components Checklist

7. LAB PREPARATION (5 minutes)

Inform students that they will look at a tractor and trailer on the range to complete this introduction. Briefly describe the type of vehicle by make, cab design, etc. Refer students to Tractor-Trailer Components Checklist from the student material to be used on the range.

UNIT 1.1 - REVIEW QUIZ

To be completed in class.

Part A

Identify the numbered parts on the tractor by putting the number in the correct box.

☐ EXHAUST STACK

☐ CAB

☐ MUFFLER

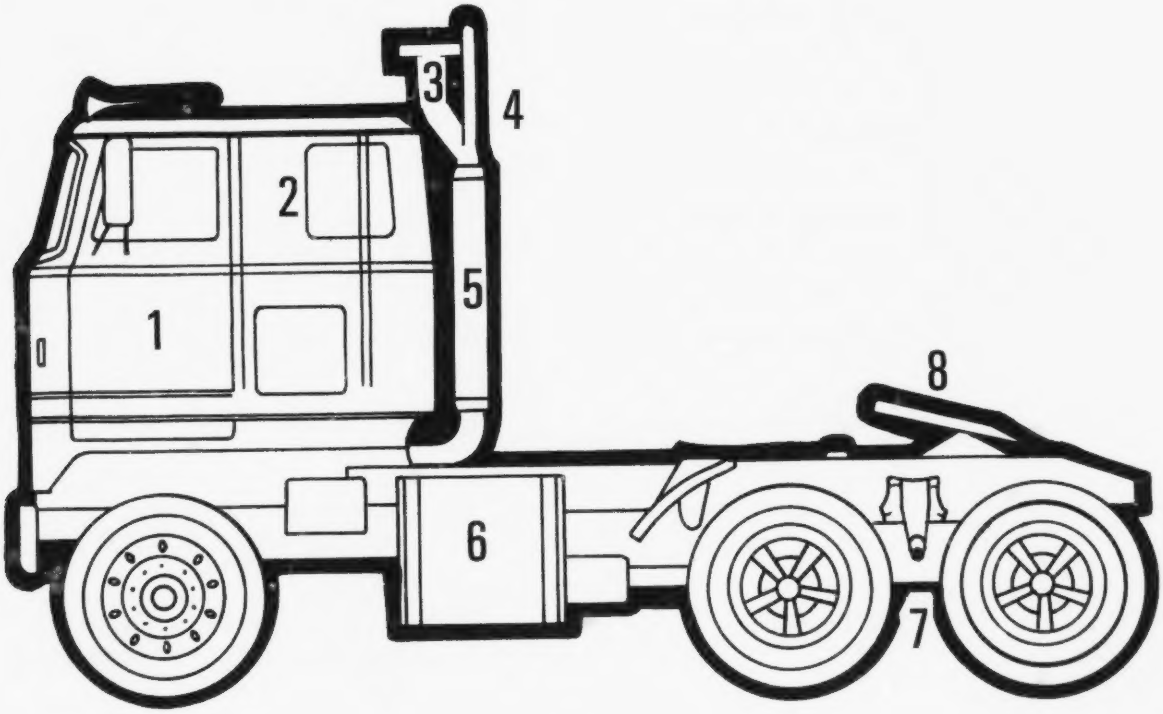
☐ AIR INTAKE STACK (SNORKEL)

☐ SLEEPER BERTH

☐ FIFTH WHEEL

☐ FUEL TANK

☐ TANDEM AXLE



UNIT 1.1 - REVIEW QUIZ

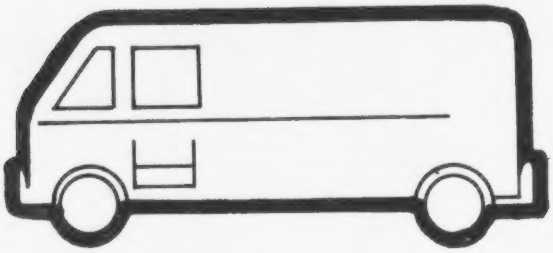
Part B

Match the term in Column A with the best identification in Column B.

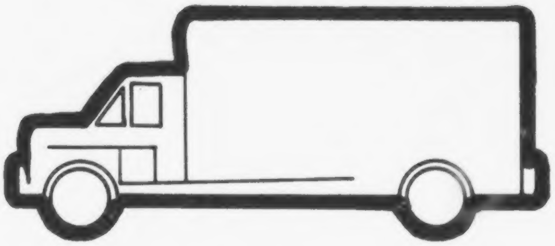
Column A	Column B
____ 1. Tractor with a tag axle	A. Controls distance that a brake shoe travels to apply force.
____ 2. Dry tank	B. A tandem axle assembly in which the forward axle is "live."
____ 3. Pintle hook	C. A "blower" driven by exhaust gases.
____ 4. Slack adjusters	D. Stores compressed air before it is used in air-braking system.
____ 5. Drawbar	E. Connects semi-trailer to a fifth wheel.
____ 6. Trailer kingpin	F. Metal fixtures at the end of air hoses and on the trailer body.
____ 7. Trolley valve	G. Provides braking to the trailer wheels only.
____ 8. Gladhands	H. Air brake connections color code.
____ 9. Blue service hose and	I. Device on a full trailer that connects it to the towing vehicle.
____10. Turbocharger	J. Device on a towing vehicle that a drawbar is connected to.

Visual 1

Straight Truck & Truck Tractor



Straight Truck



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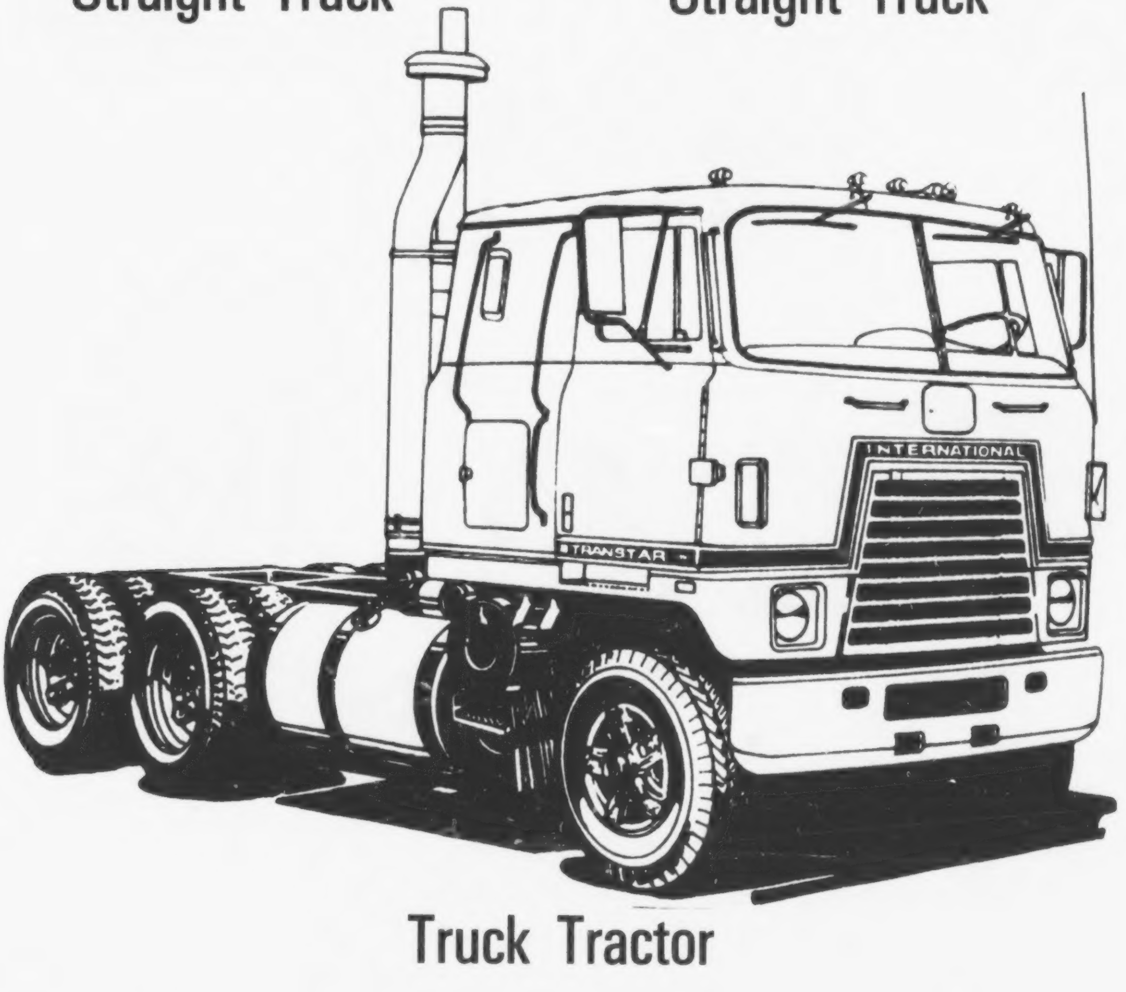
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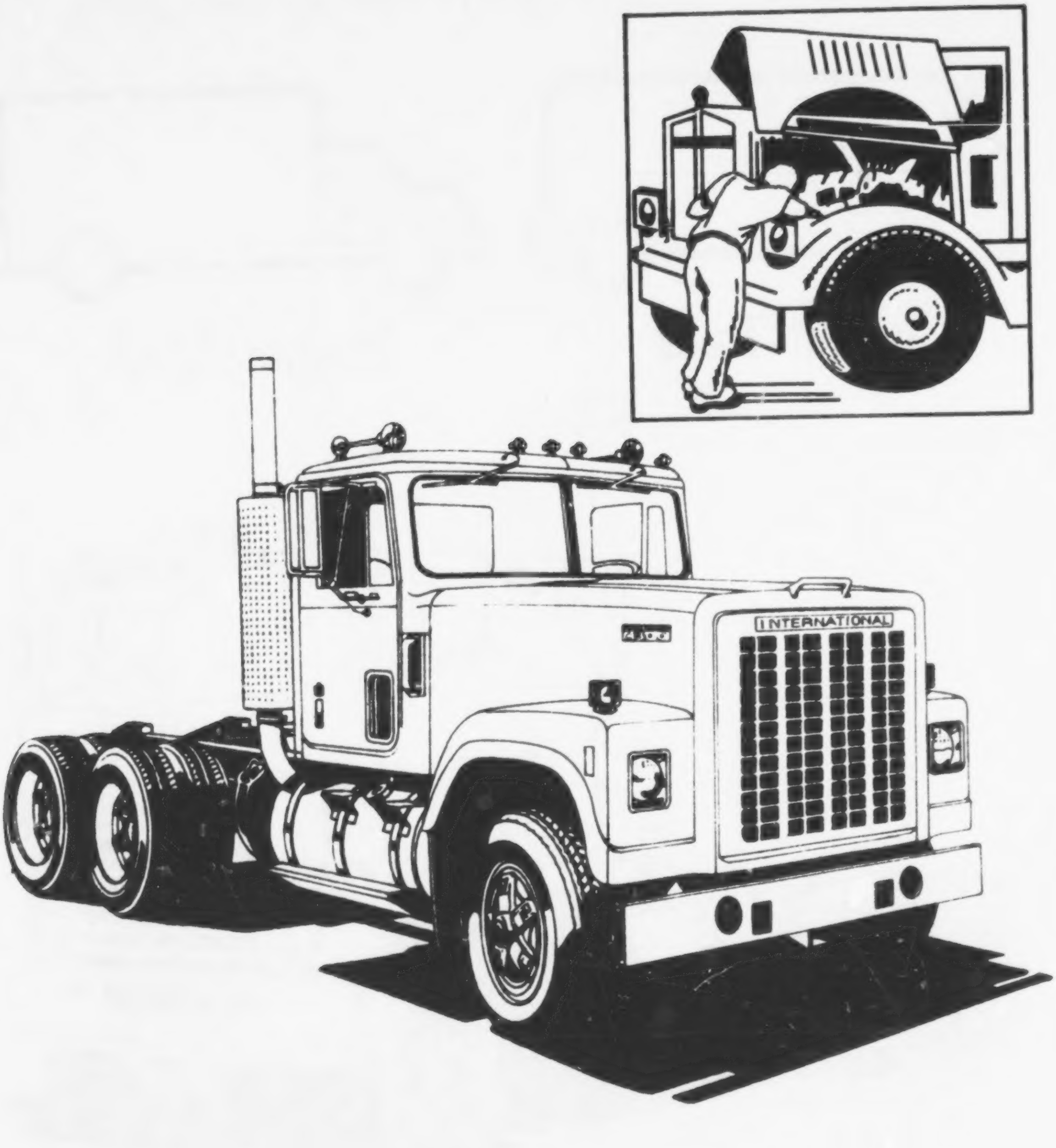
Truck Tractor

Visual 2

Conventional Cab Design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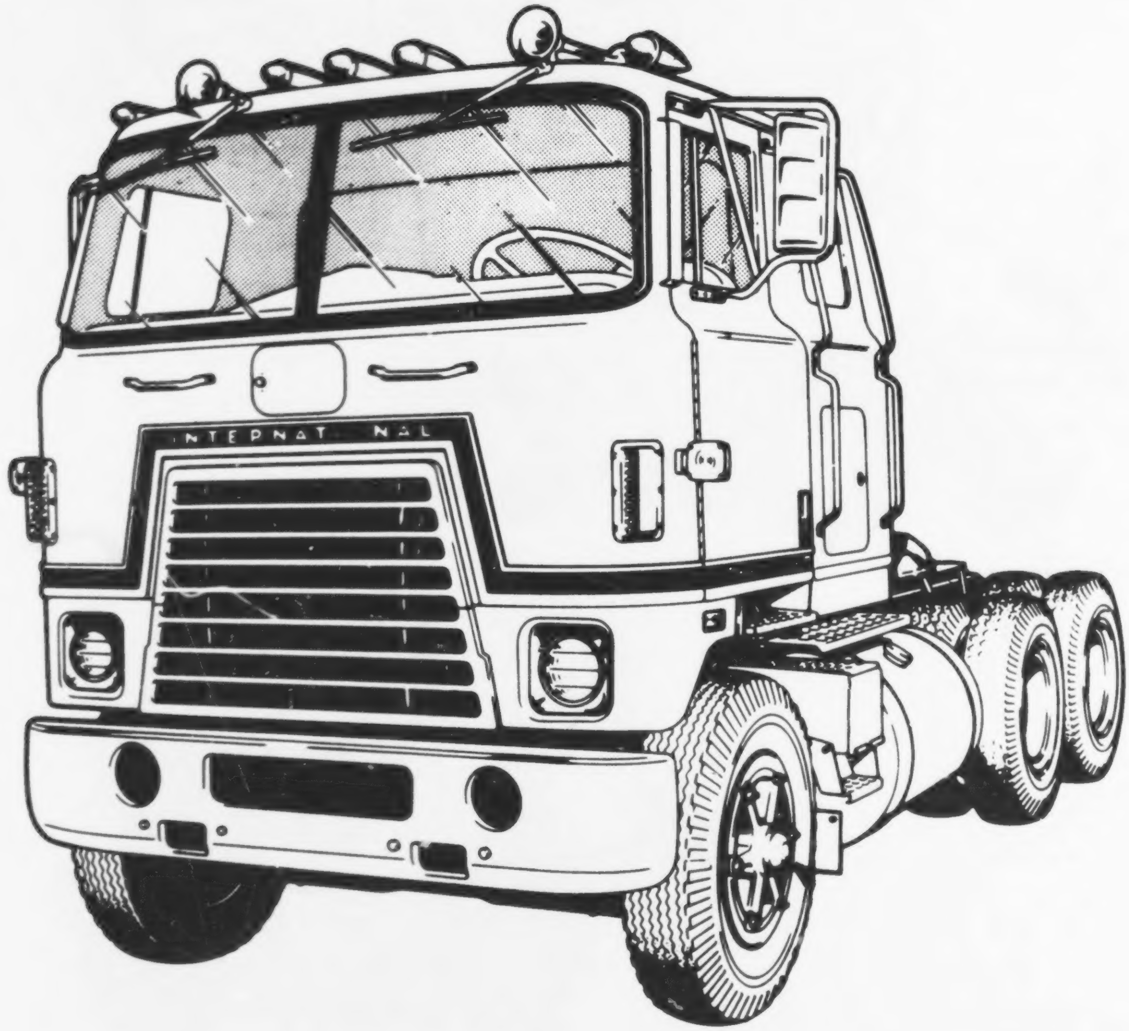
Visual 3

Cab-Over-Engine Cab Design With a Sleeper Berth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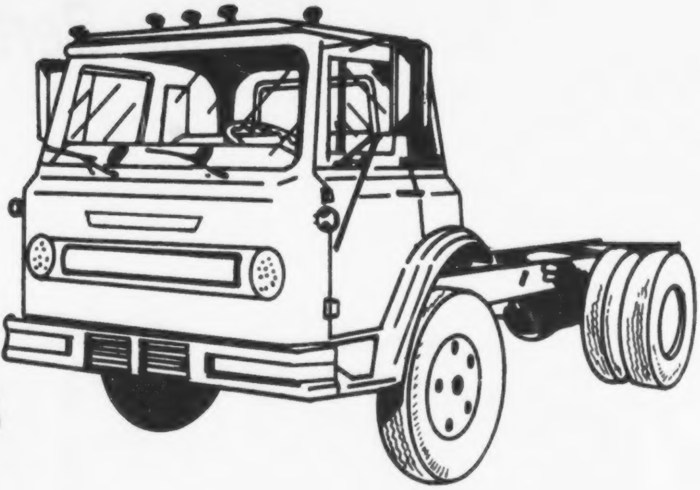
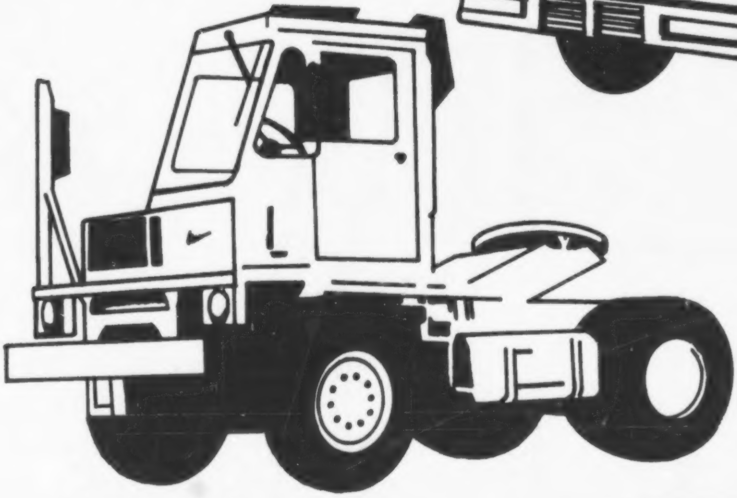
Visual 4

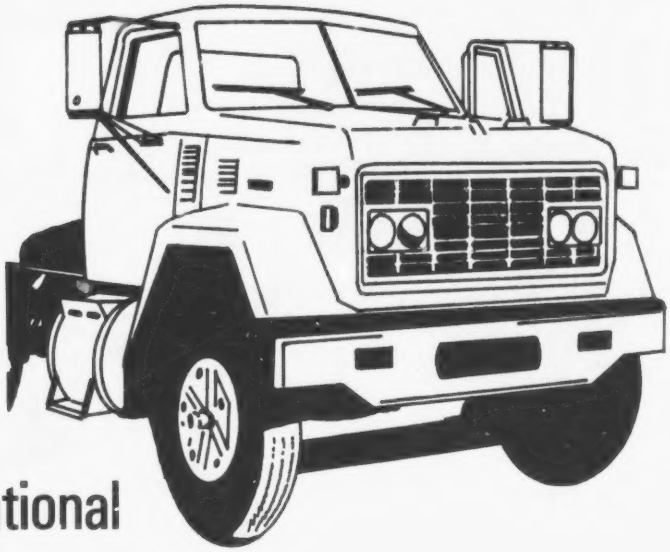
Other Cab Designs

Low Cab Forward





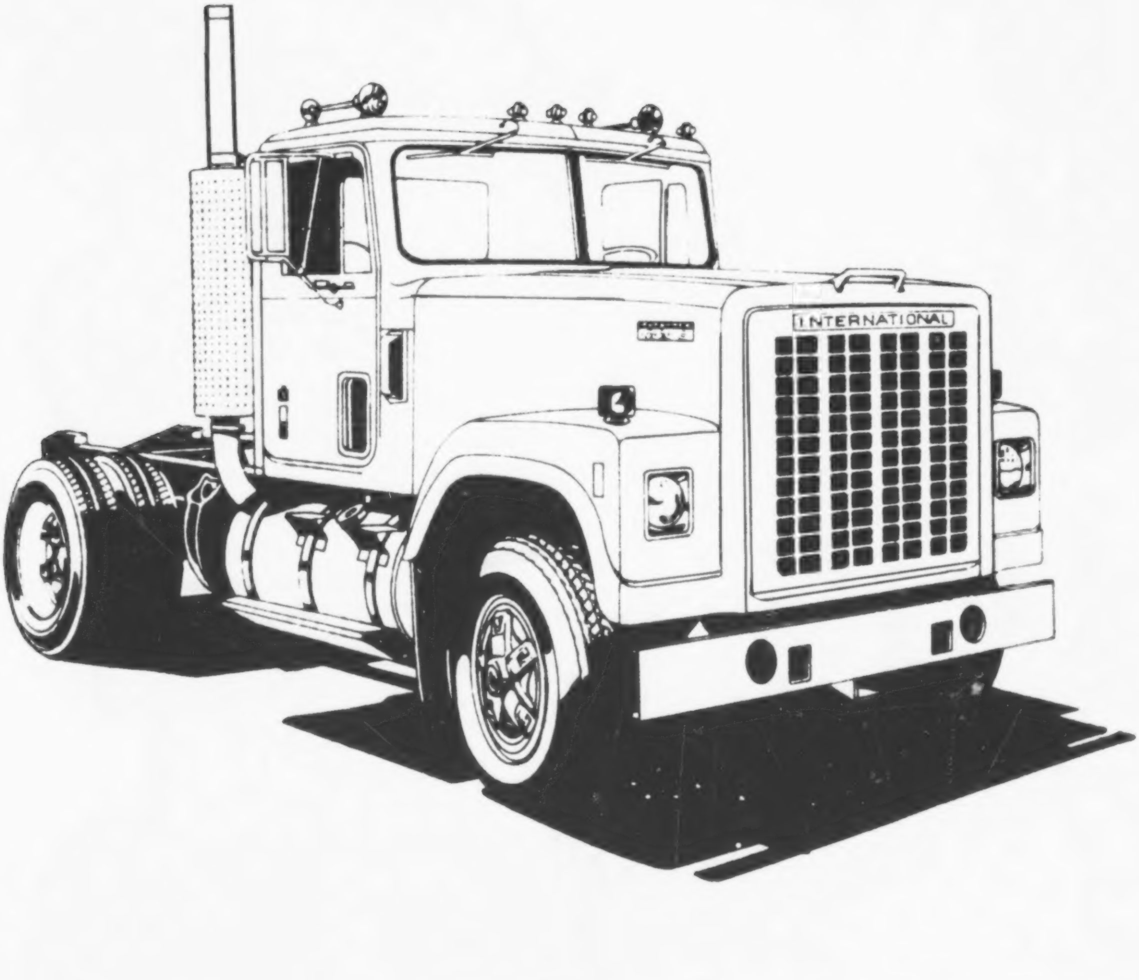
Half Cab



Short Nose Conventional

Visual 5

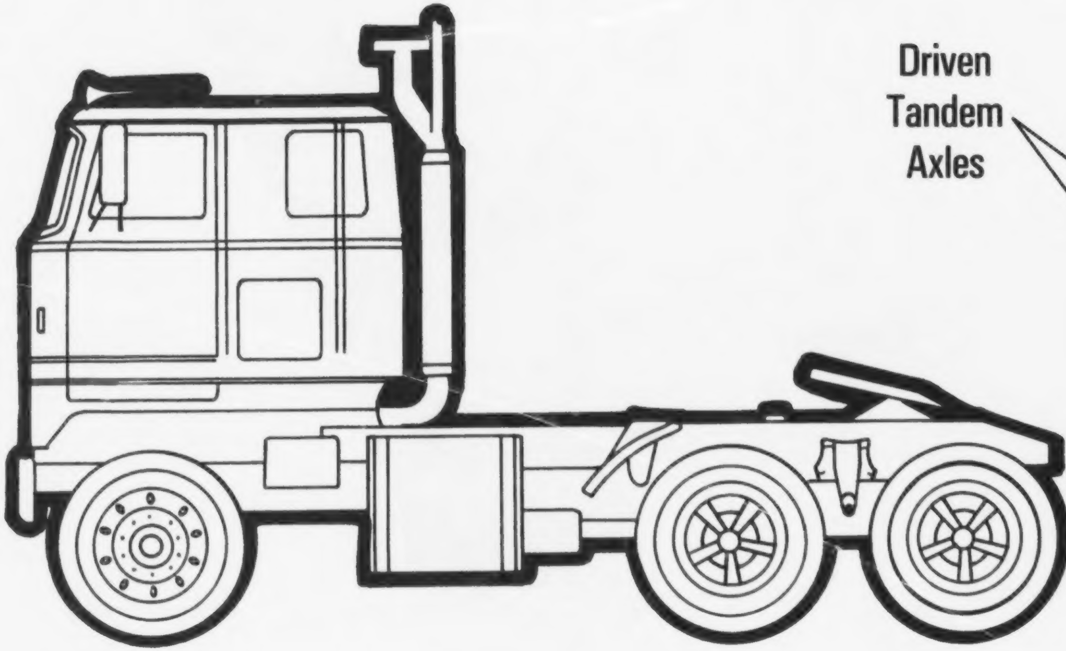
Single Axle Truck Tractor

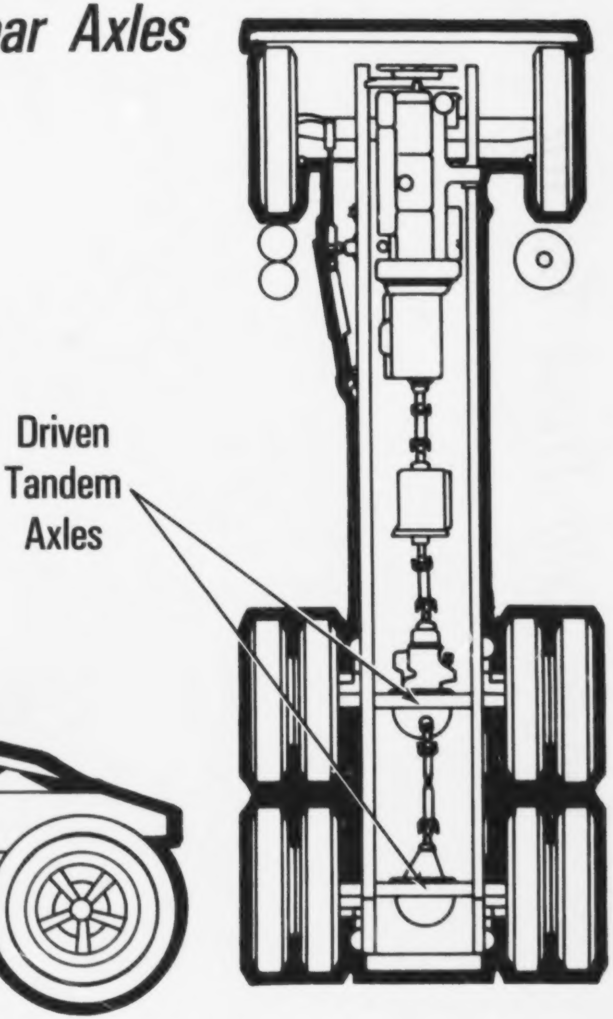

INTERNATIONAL

Tandem Axle Truck Tractor

Types of Tandem Rear Axles

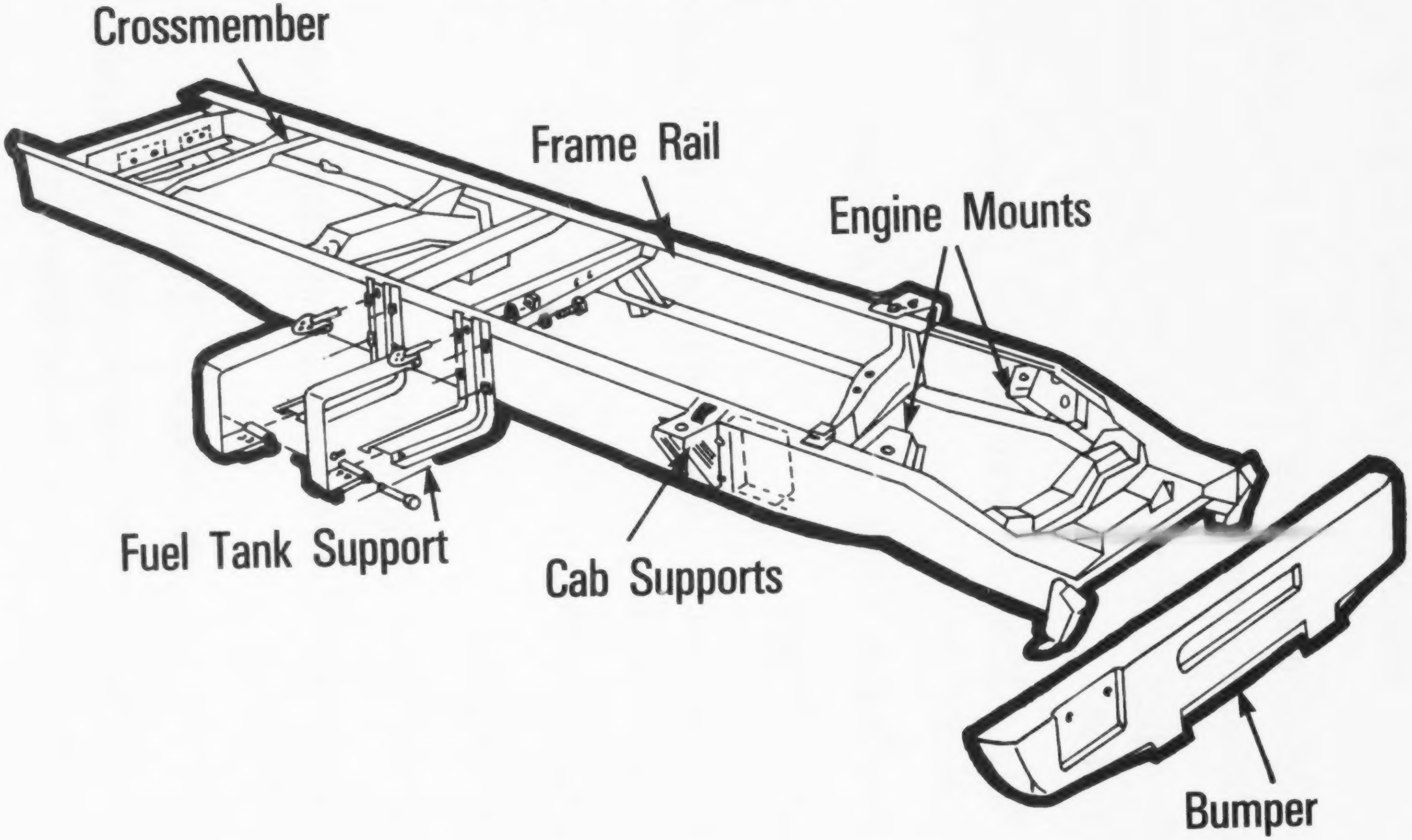
- Tag Axle
- Pusher Axle
- Twin Screw




Driven
Tandem
Axles

Frame

Key Components


Crossmember
Frame Rail
Engine Mounts
Fuel Tank Support
Cab Supports
Bumper

Gasoline and Diesel Engines

Both Gasoline and Diesel Engines Are Forms of Internal Combustion Engines.

Both Types Use the Same Principle to Make Them Run

- Pistons Move Up and Down in Cylinder to Compress Fuel and Air
- Resulting in Force to Rotate Crankshaft

Gasoline Engine

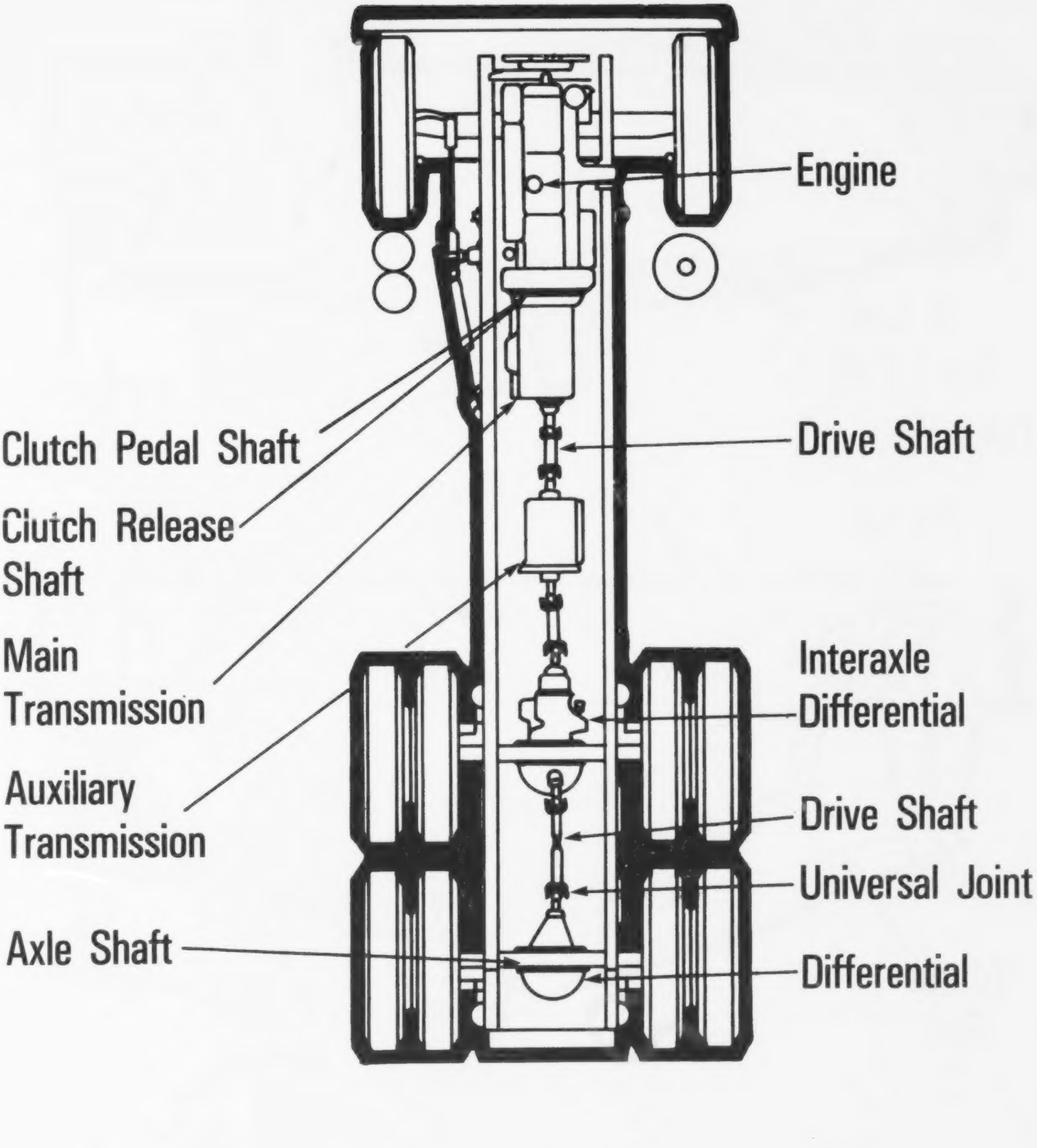
- Uses Carburetor to Vary Amount of Fuel and Air Drawn Into Engine
- Uses Sparkplug to Ignite Fuel-Air Mixture

Diesel Engines

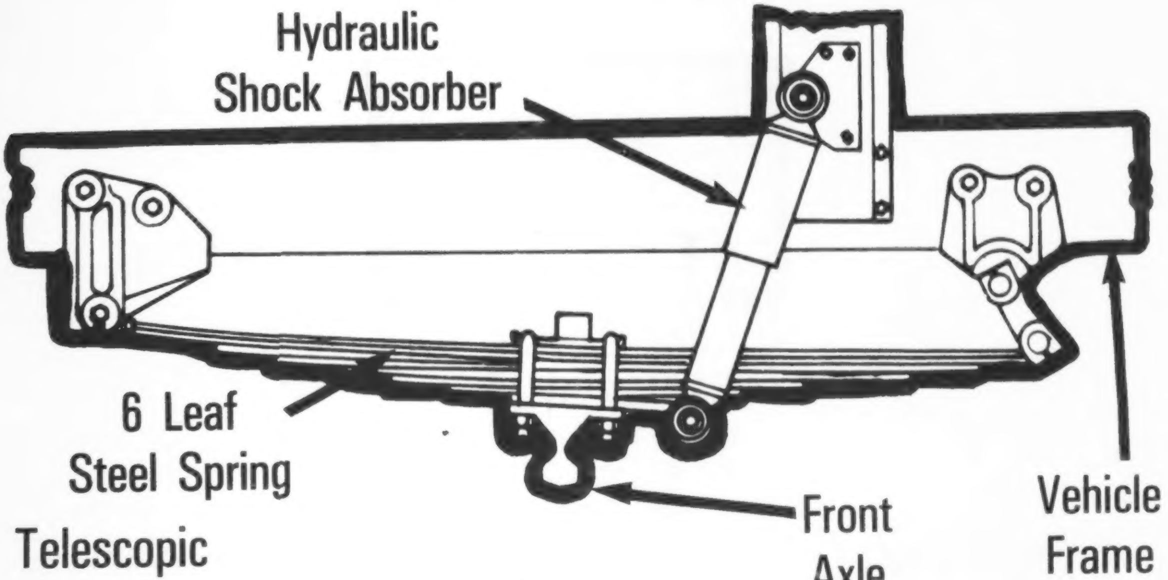
- Do Not Have Carburetors
- Fuel Sprayed Directly Into Combustion Chamber by Injectors
- Does not Use Sparkplugs for Combustion
- Combustion (Ignition) Results While Air Inside Cylinder Becomes Hot Due to Its Compression

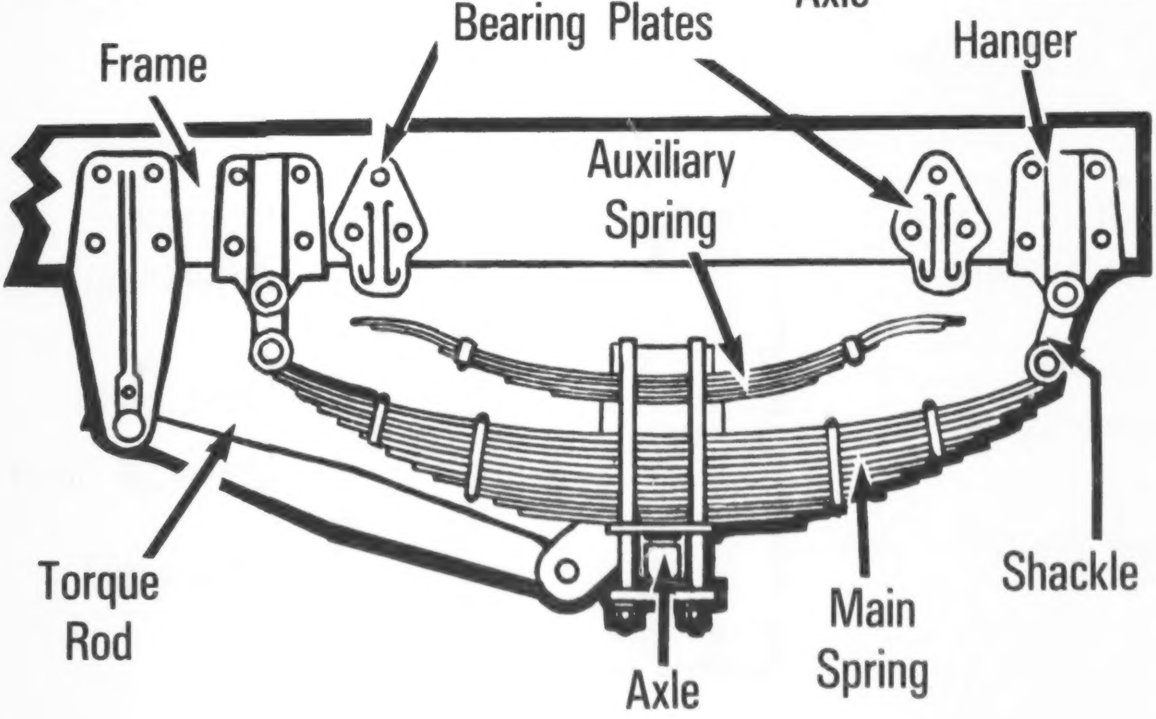
Visual 9

Drive Train
Key Components


Engine
Clutch Pedal Shaft
Drive Shaft
Clutch Release Shaft
Main Transmission
Interaxle Differential
Auxiliary Transmission
Drive Shaft
Universal Joint
Axle Shaft
Differential

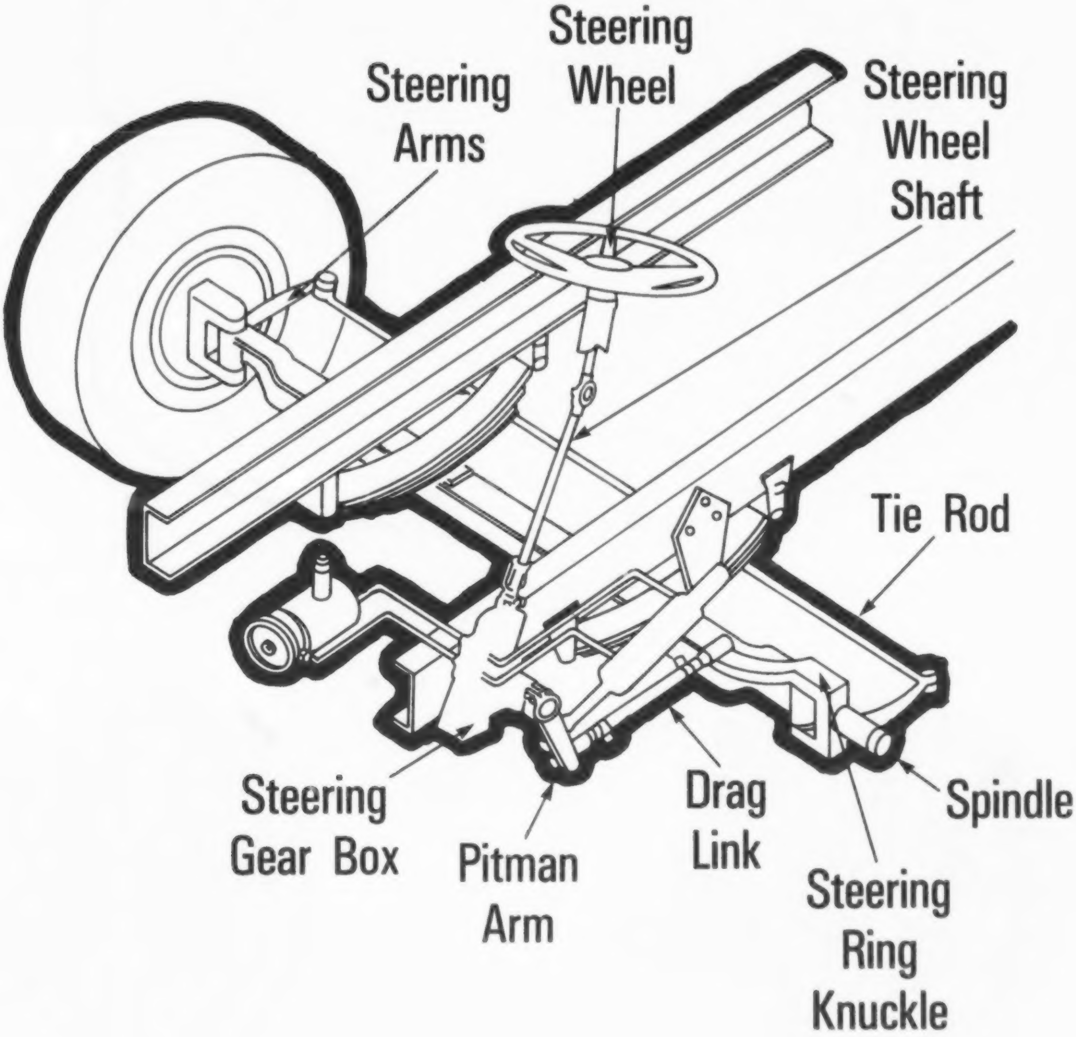
Suspension
Key Components


Hydraulic
Shock Absorber
6 Leaf
Steel Spring
Front
Axle
Vehicle
Frame
Telescopic


Frame
Bearing Plates
Hanger
Auxiliary
Spring
Torque
Rod
Axle
Main
Spring
Shackle

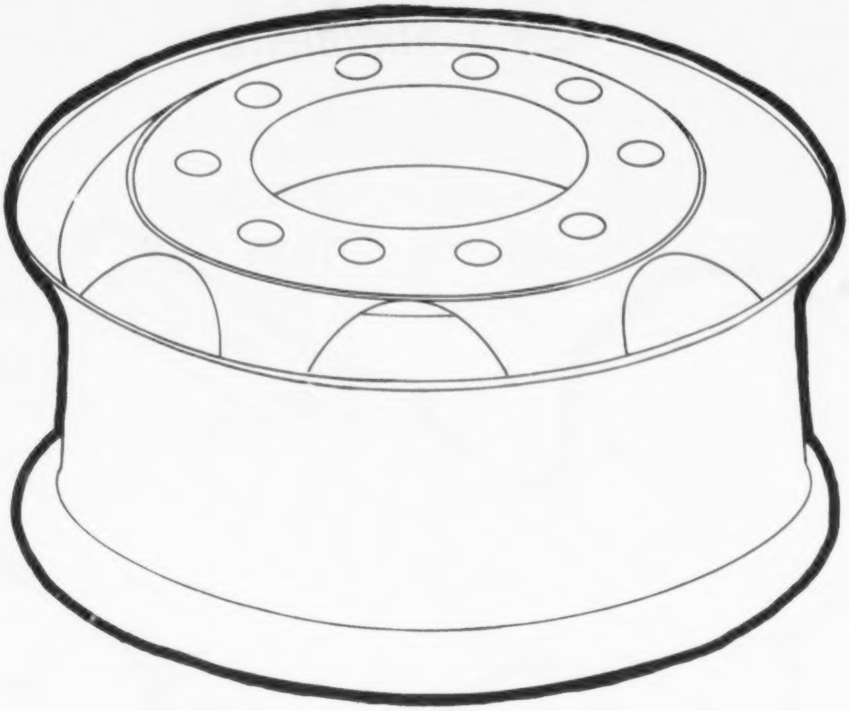
Visual 11

Steering System
Key Components

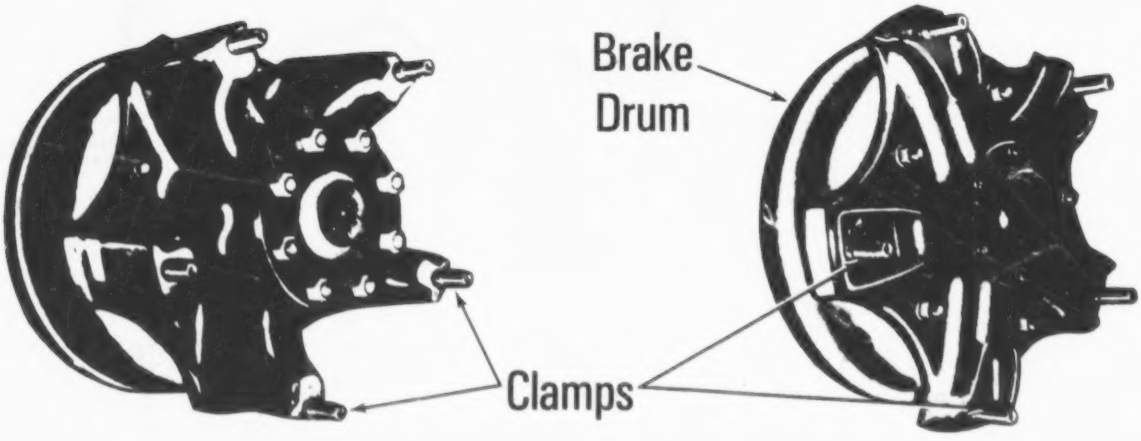

Steering Wheel
Steering Arms
Steering Wheel Shaft
Tie Rod
Steering Gear Box
Pitman Arm
Drag Link
Spindle
Steering Ring Knuckle

Visual 12

Wheels and Tires

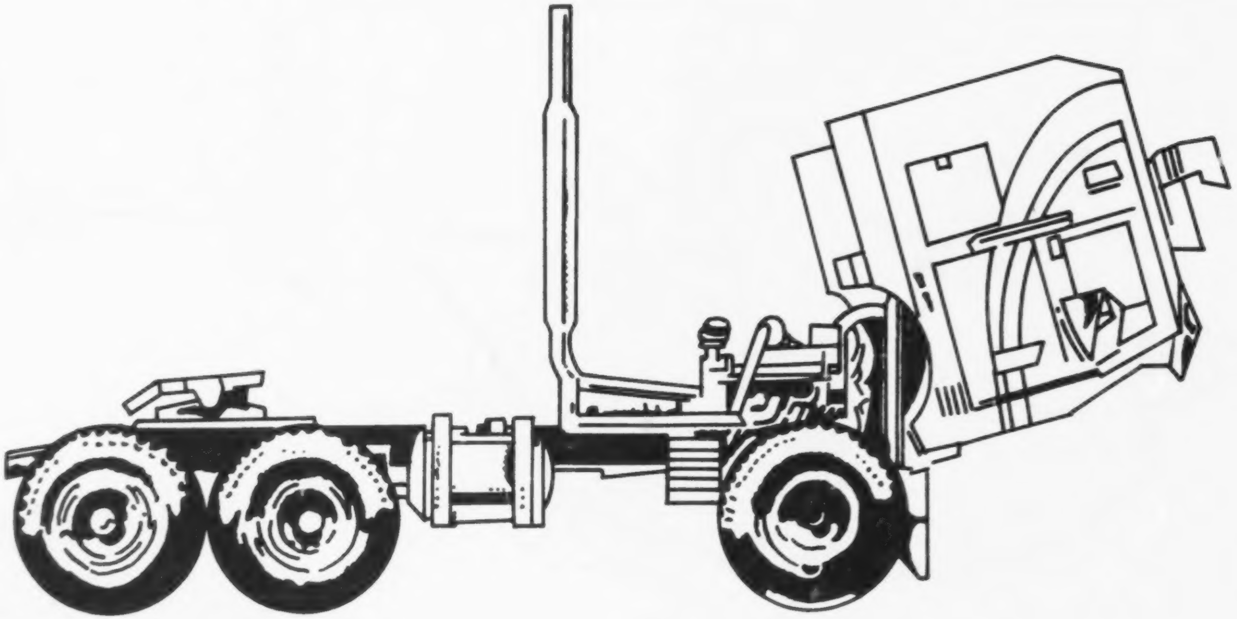


Disc Wheel


Brake
Drum
Clamps

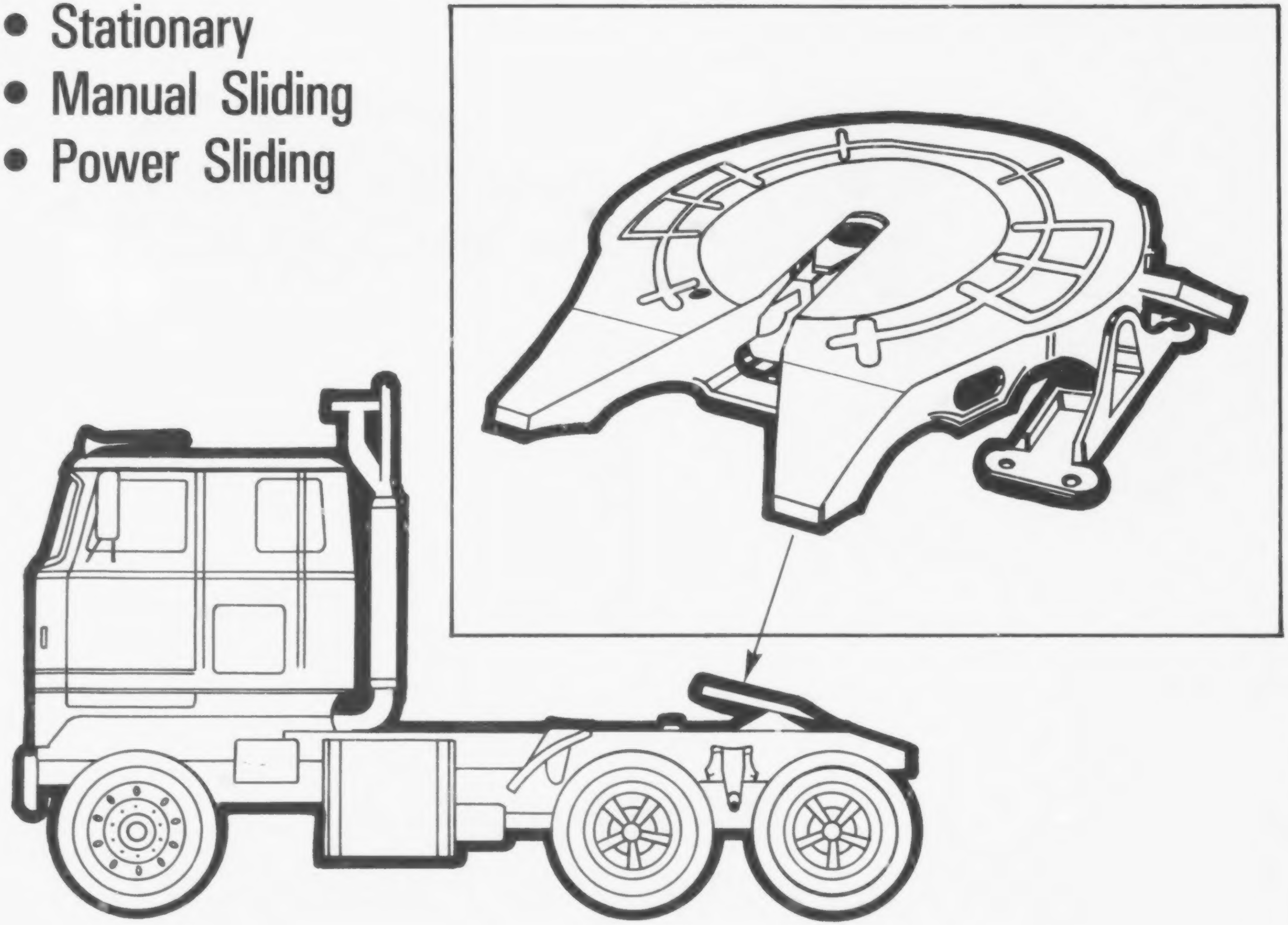
Cast Spoke Wheel

COE Sleeper Cab Tractor With Cab in Tilted Position



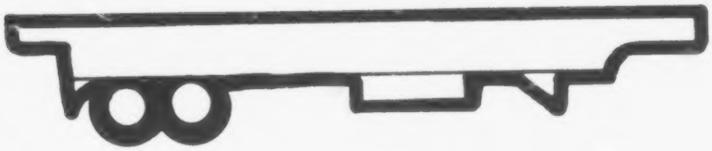
Types of Fifth Wheels

- Stationary
- Manual Sliding
- Power Sliding

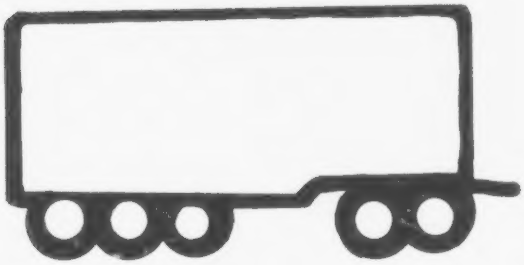


Visual 15

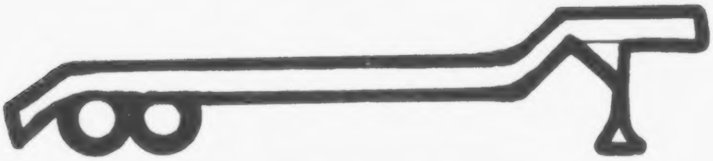
Basic Trailer Types



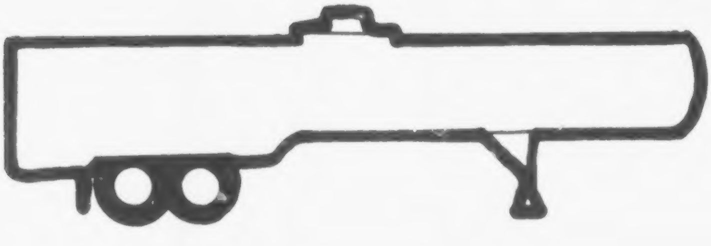
Semi-Trailer



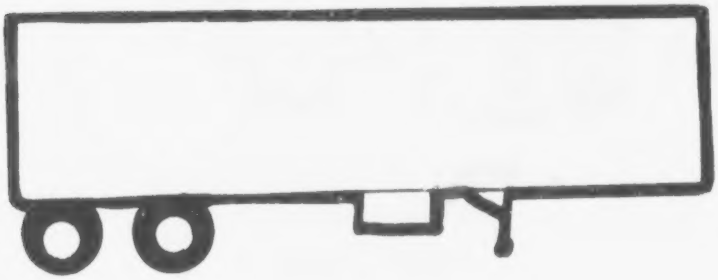
Full Trailer



Drop Frame
Flat Bed



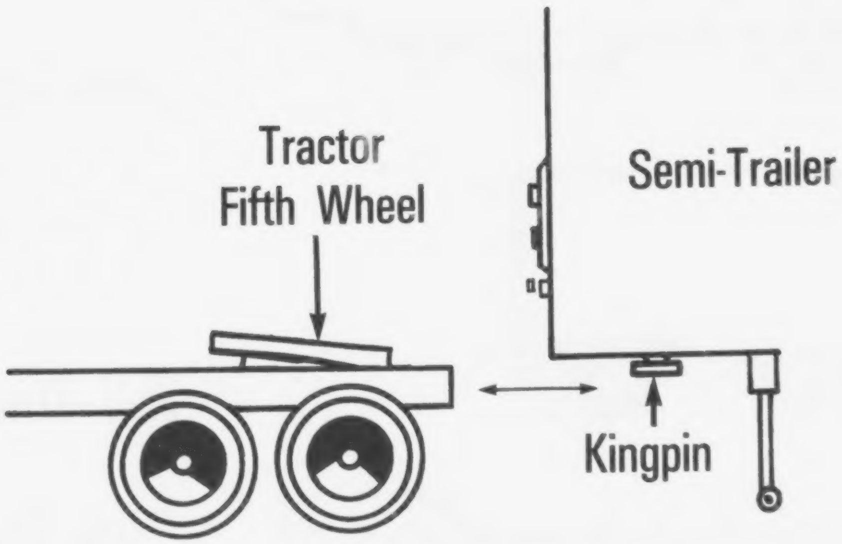
Tank Body

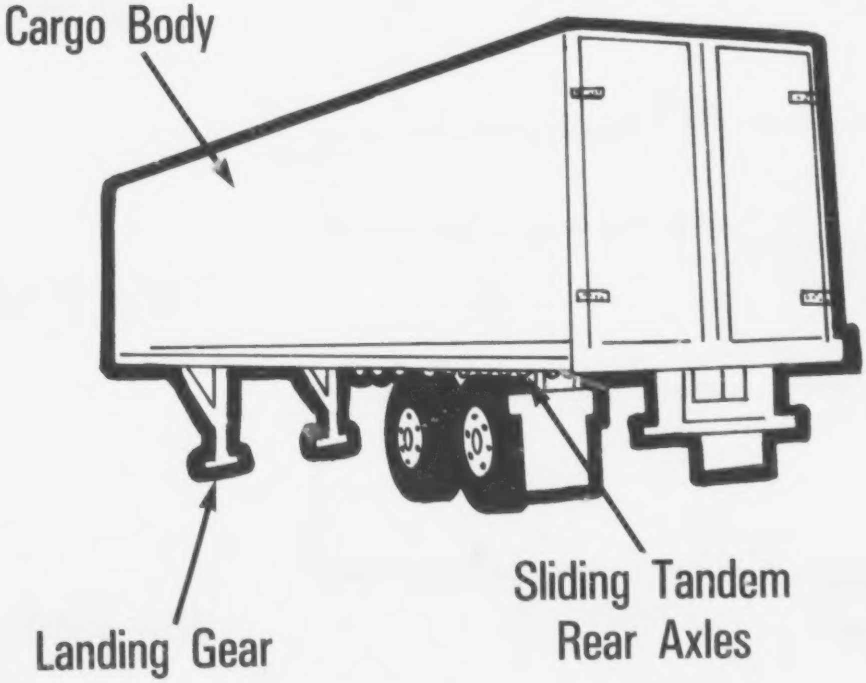


Van Body

Visual 16

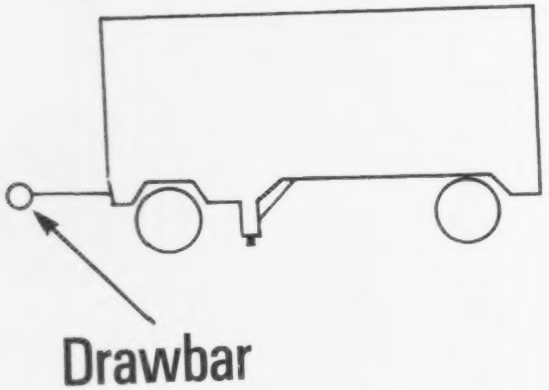
Semi-Trailer
Key Components

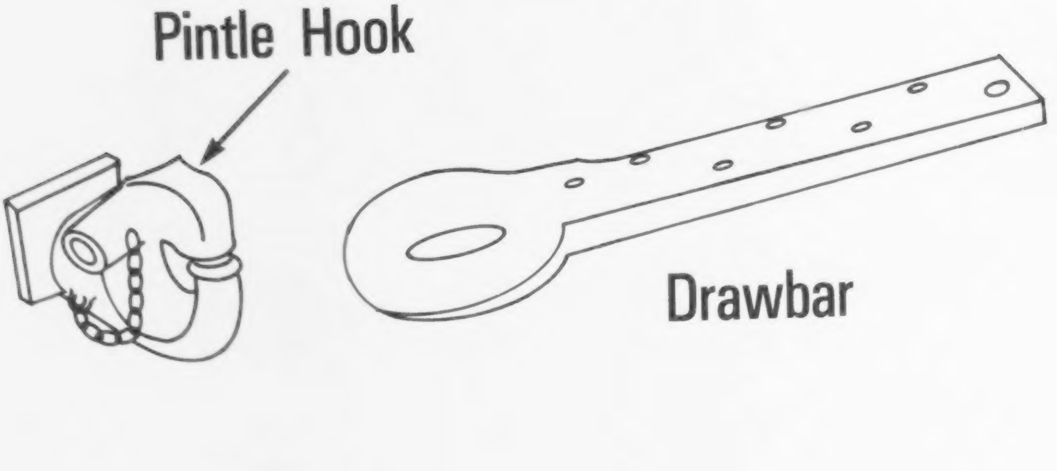

Tractor
Fifth Wheel
Semi-Trailer
Kingpin


Cargo Body
Landing Gear
Sliding Tandem
Rear Axles

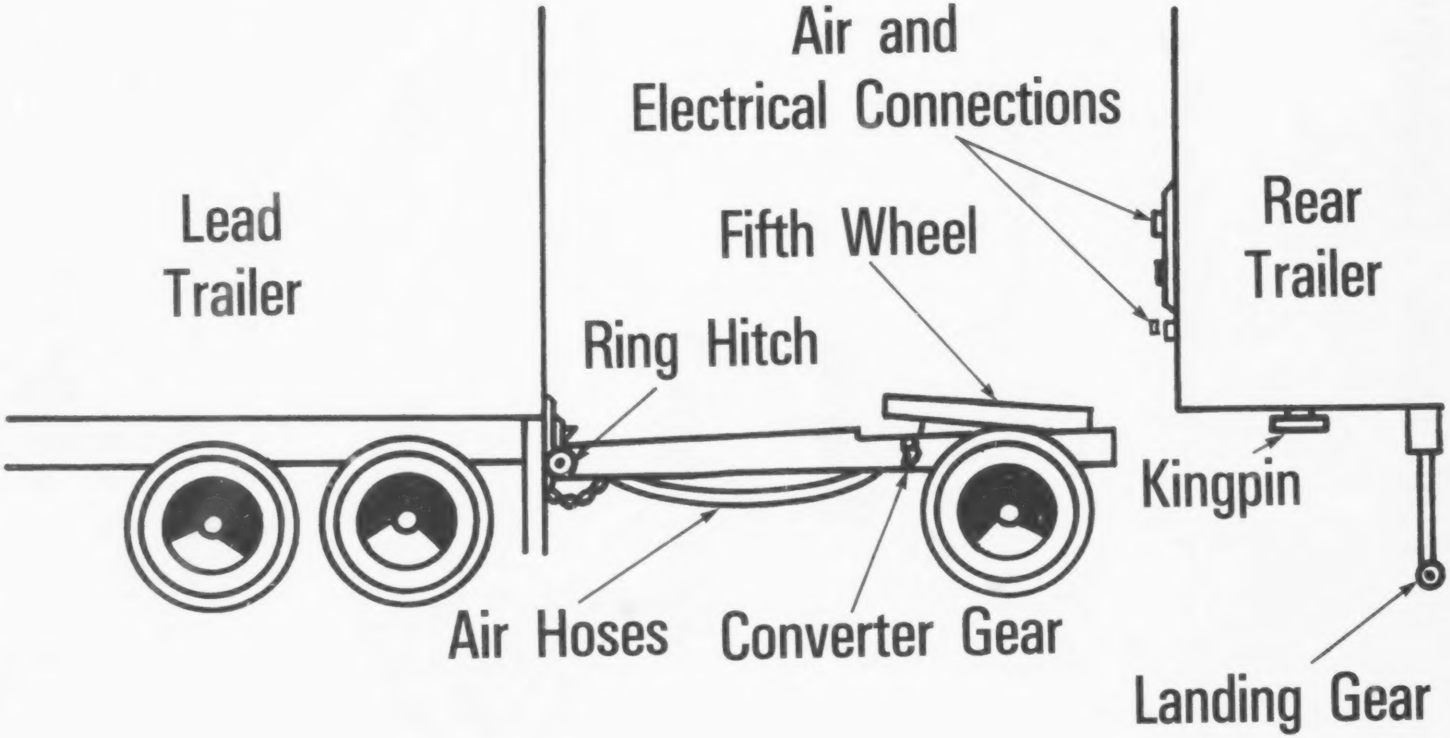
Visual 17

Full Trailer Couplings



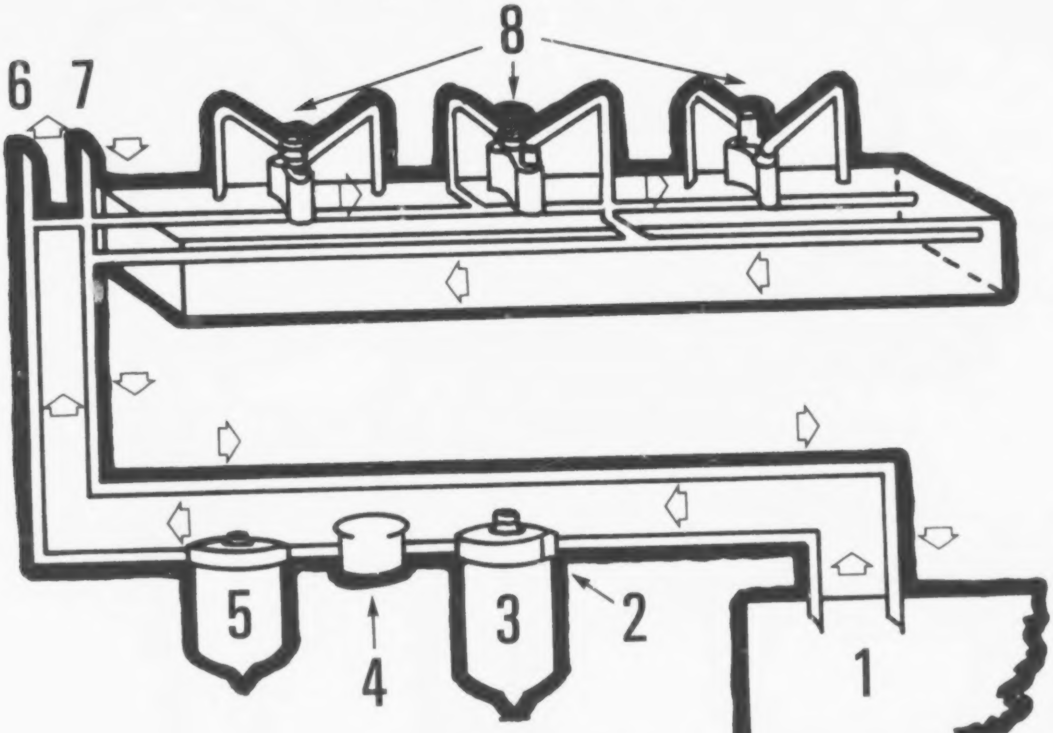

Pintle Hook
Drawbar

Converter Gear


Air and
Electrical Connections
Lead
Trailer
Fifth Wheel
Rear
Trailer
Ring Hitch
Kingpin
Air Hoses
Converter Gear
Landing Gear

Fuel System

Key Components

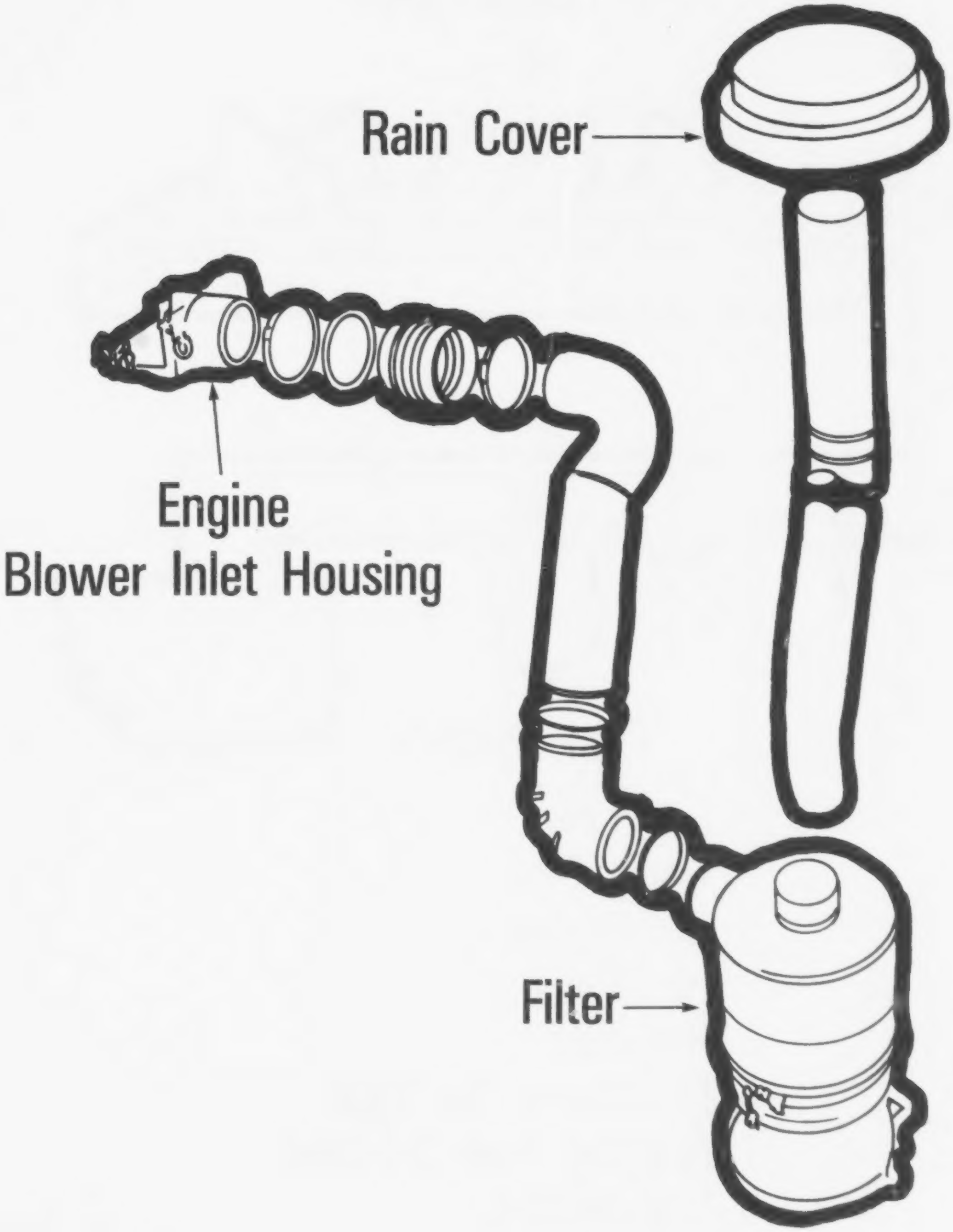


Fuel System

1. Fuel Tank
2. Check Valve
3. Fuel Strainer
4. Fuel Pump
5. Fuel filter
6. Fuel Line to 2nd Head
7. Fuel Line From 2nd Head
8. Fuel Injectors

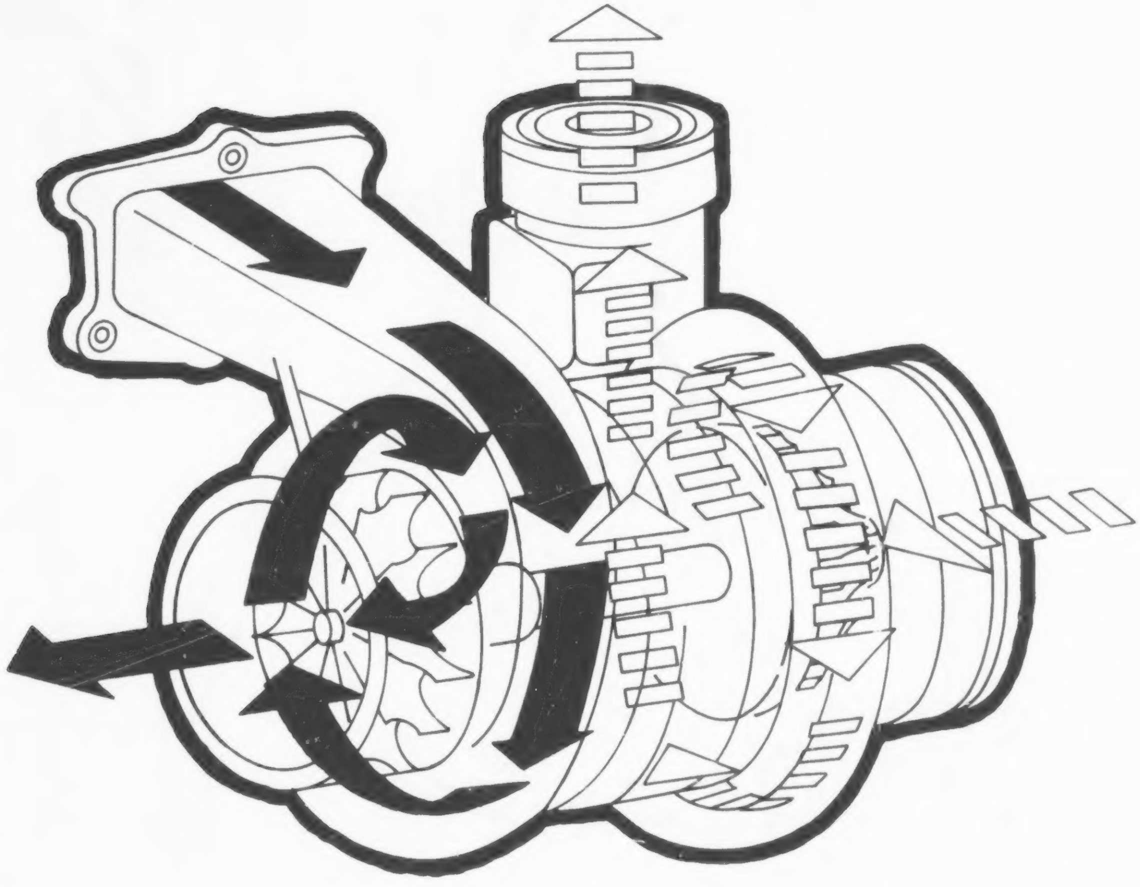
Visual 20

Air Intake System


Rain Cover
Engine
Blower Inlet Housing
Filter

Visual 21

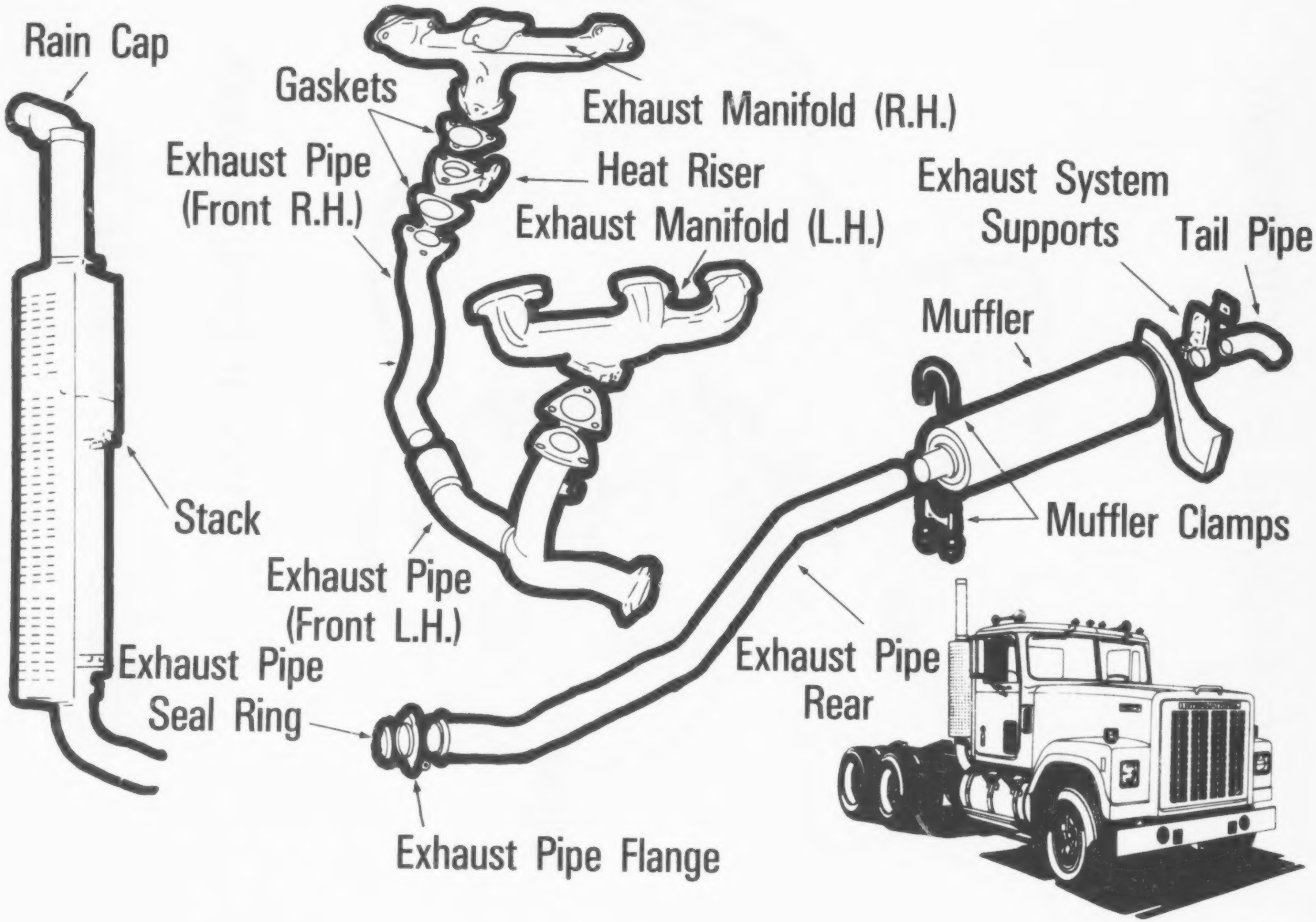
Example of a Turbocharger



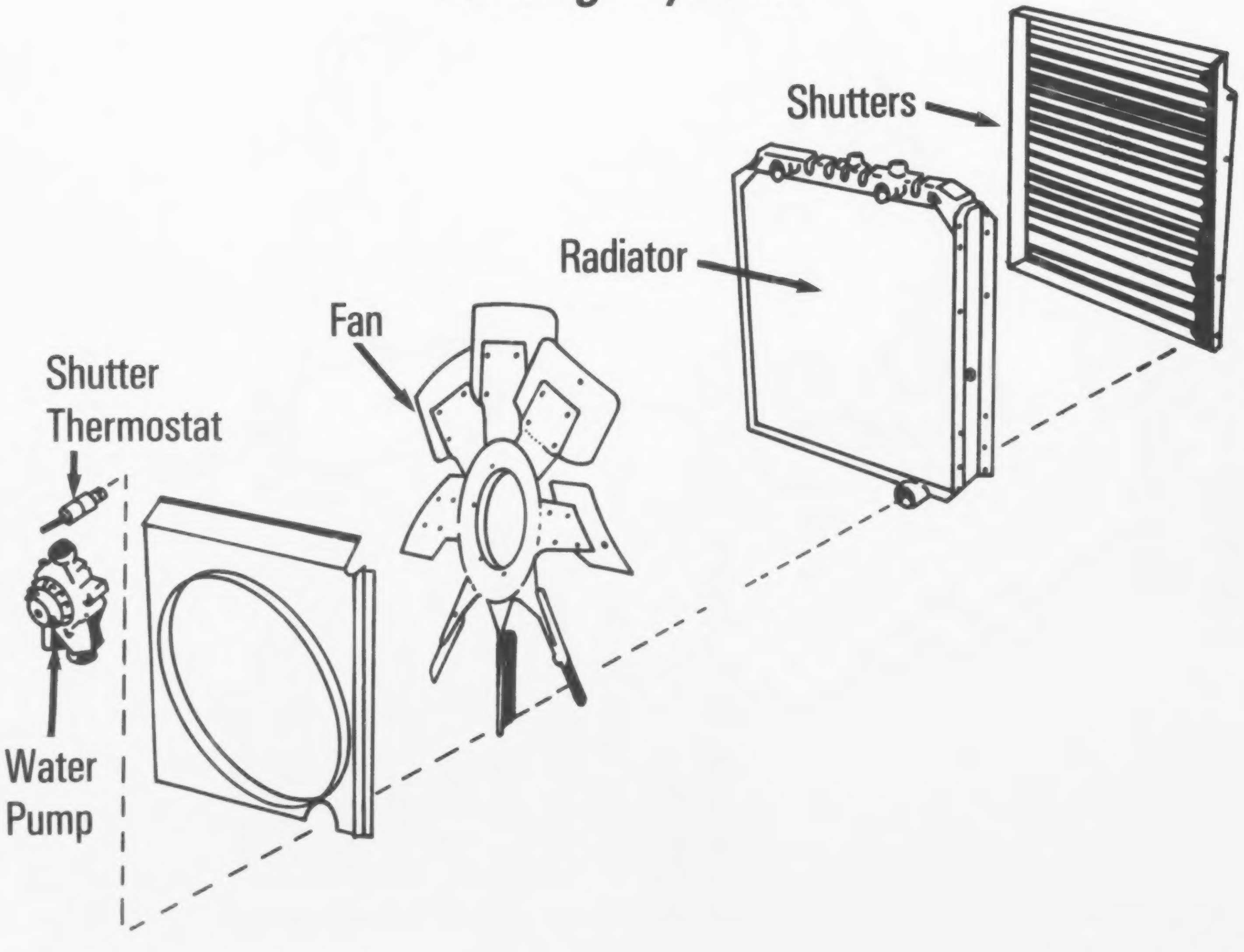
◁□□□ Flow of Exhaust Gases

◀ Flow of Intake Air

Exhaust System

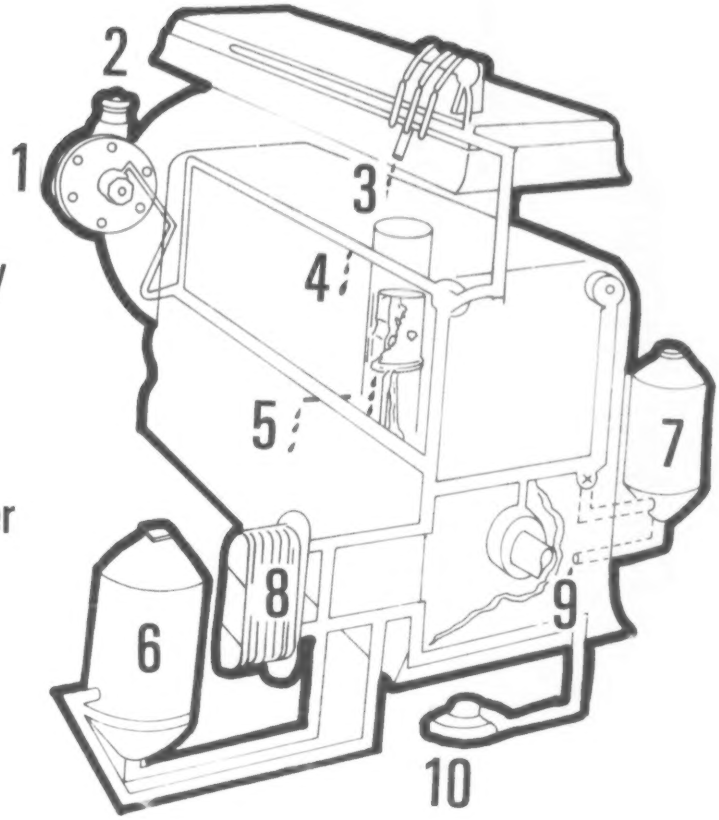

Rain Cap
Gaskets
Exhaust Manifold (R.H.)
Exhaust Pipe (Front R.H.)
Heat Riser
Exhaust Manifold (L.H.)
Exhaust System Supports
Tail Pipe
Muffler
Stack
Muffler Clamps
Exhaust Pipe (Front L.H.)
Exhaust Pipe Seal Ring
Exhaust Pipe Rear
Exhaust Pipe Flange

Cooling System


Shutters
Radiator
Fan
Shutter Thermostat
Water Pump

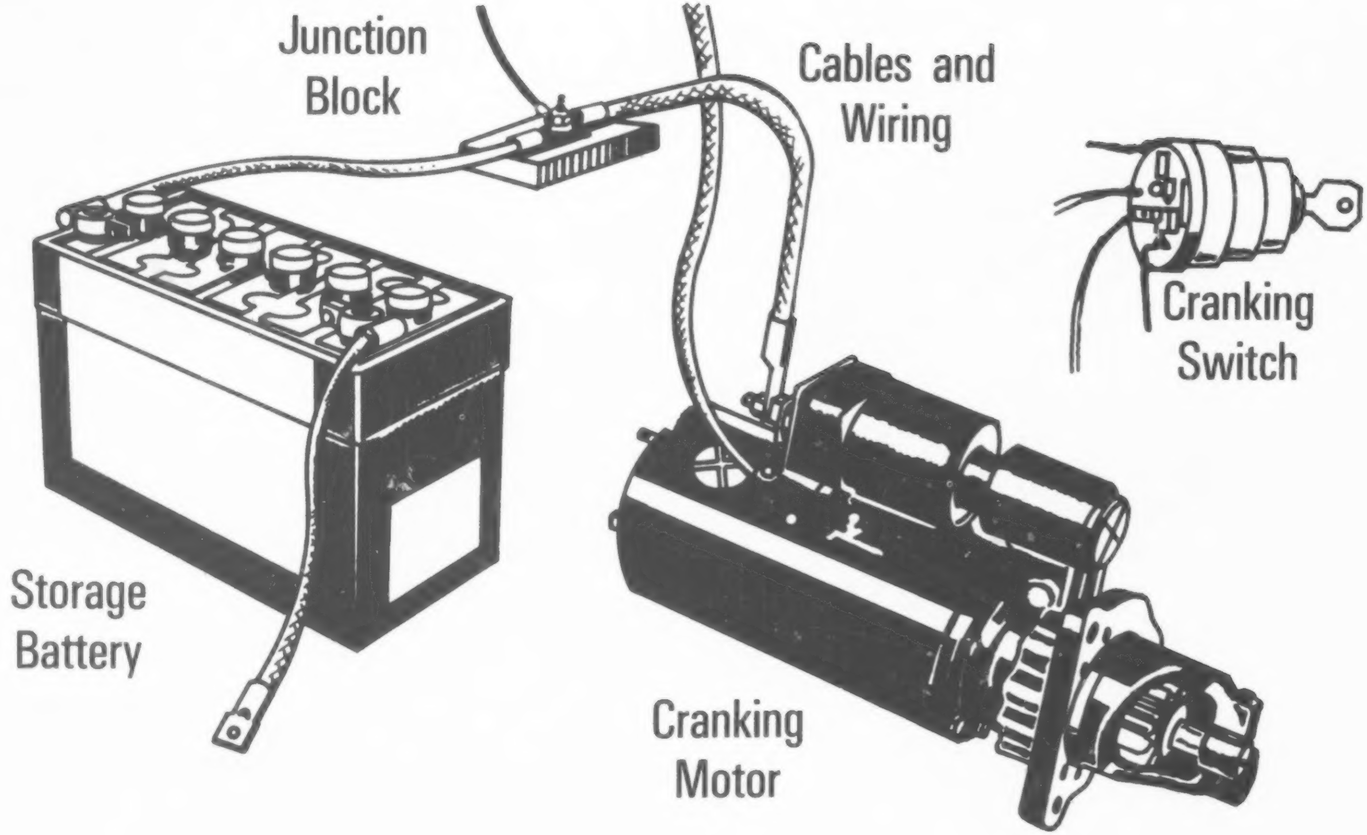
Lubricating System
Key Components

1. Oil From Main Gallery
2. Oil Filter
3. Rocker and Drain
4. Cam Pocket Drain
5. Oil Drain From Blower
6. Full Flow Filter
7. Bypass Filter
8. Oil Cooler
9. Drain to Oil Pan
10. Inlet Screen

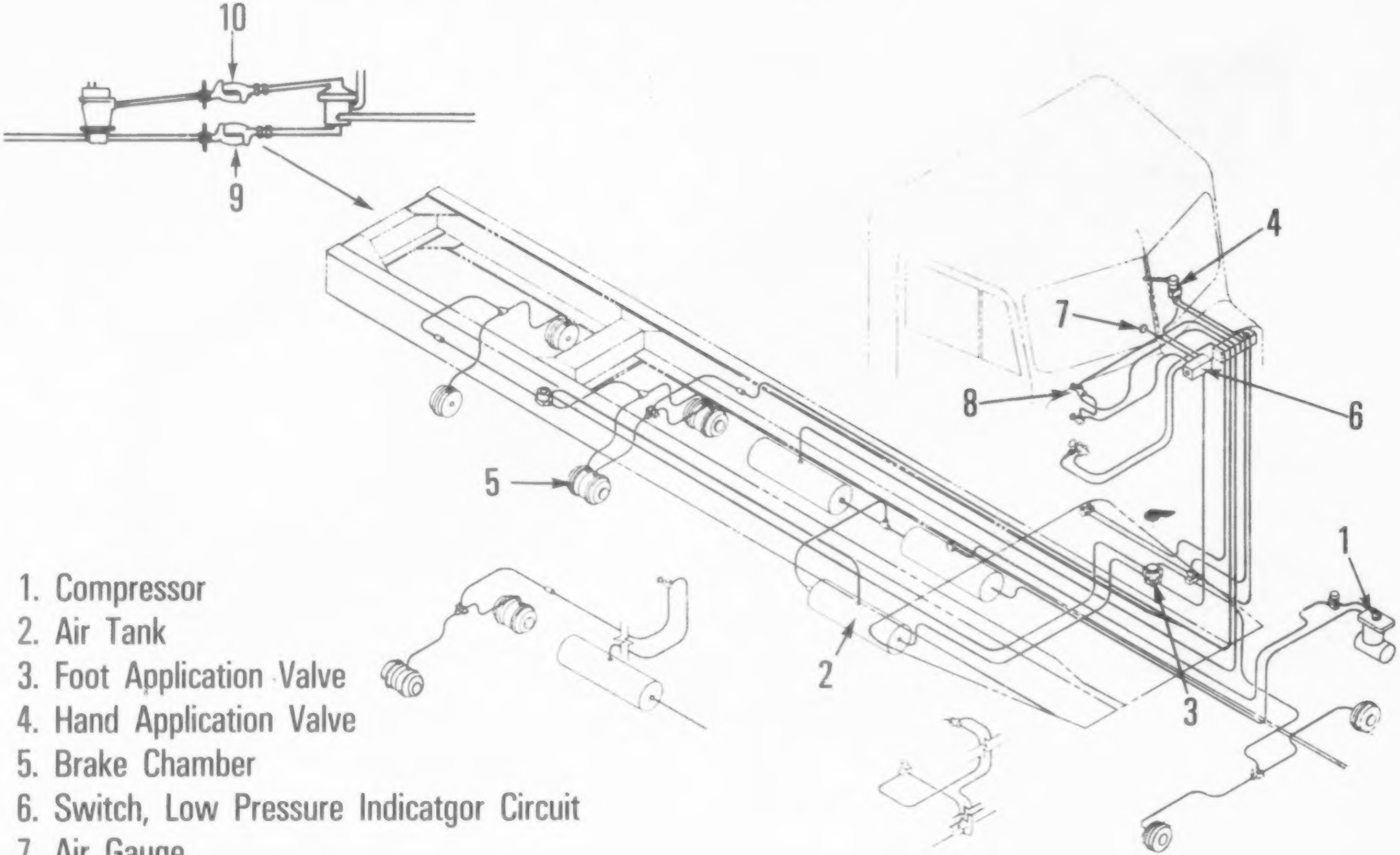


Visual 25

Cranking System


Junction Block
Cables and Wiring
Cranking Switch
Storage Battery
Cranking Motor

Tractor Air Braking System

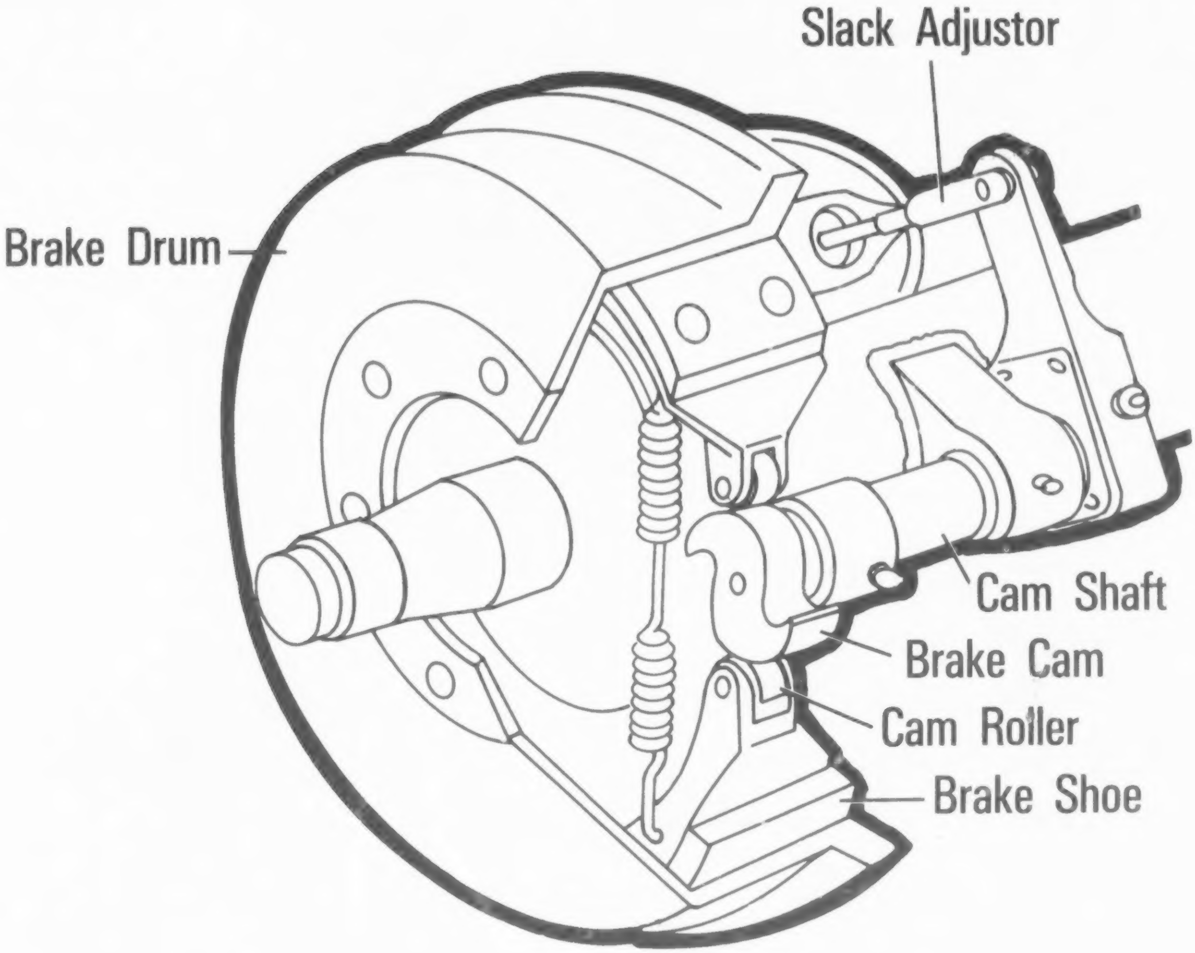


1. Compressor
2. Air Tank
3. Foot Application Valve
4. Hand Application Valve
5. Brake Chamber
6. Switch, Low Pressure Indicatgor Circuit
7. Air Gauge
8. Emergency Brake Valve
9. Emergency Air Line and Glad Hand
10. Service Air Line and Glad Hand

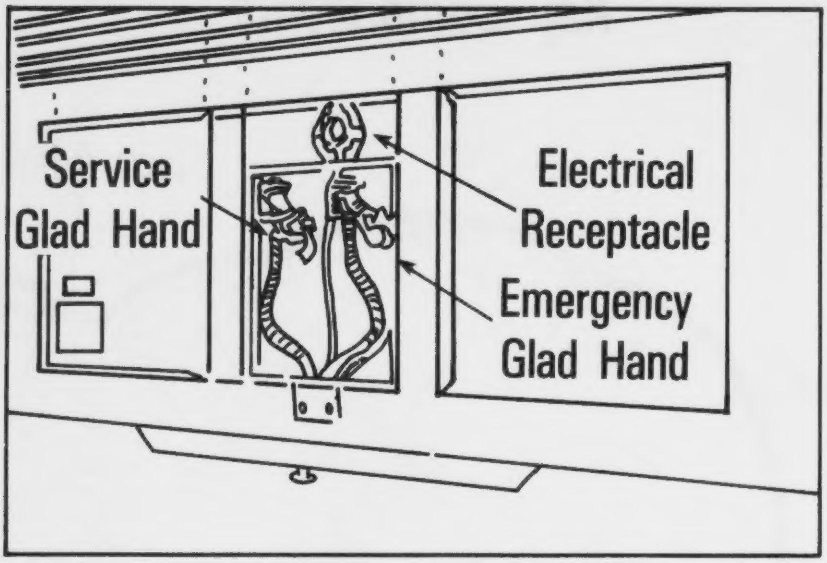
Visual 27

Drum Brake

Key Components

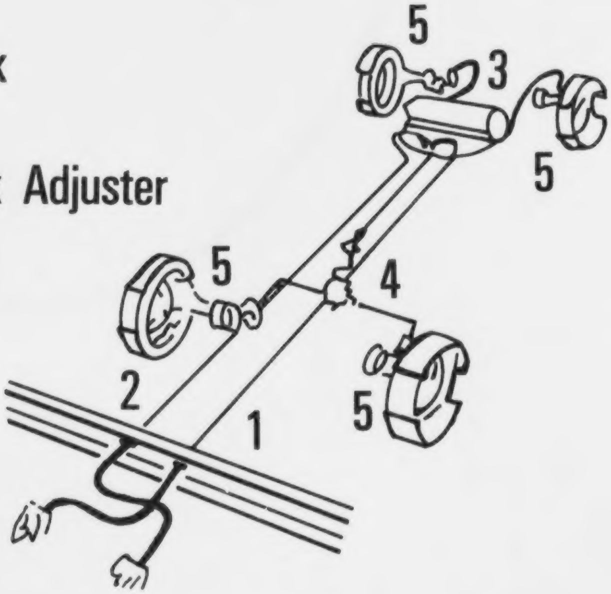

Slack Adjustor
Brake Drum
Cam Shaft
Brake Cam
Cam Roller
Brake Shoe

Trailer Air Braking System


Service Glad Hand
Electrical Receptacle
Emergency Glad Hand

Front of Trailer

1. Emergency Air Line
2. Service Air Line
3. Close-Coupled Trailer Tank
4. Quick Release Valve
5. Brake Chamber and Slack Adjuster



Tractor-Trailer Components Checklist

Under the Hood/Cab

- Oil and coolant level indicators
- Engine
- Radiator
- Cranking motor
- Fuel pump
- Filters
- Belts

Key Cab Parts

- Sleeper berth
- Storage compartment
- Instrument panel
- Vehicle controls

Tractor

- Front wheels
- Steering linkage
- Front suspension
- Brake Parts
  - Drums or discs
  - Brake chambers
  - Slack adjusters
  - Air lines
- Air compressor
- Air tanks

Tractor (continued)

- Fuel tanks
- Exhaust stack and muffler
- Intake stack and air cleaner assembly
- Batteries
- Air horns, lights, and reflectors
- Coupling device
- Mud flaps
- Rear axles, wheels and tire
- Rear suspension
- Fifth wheel

Trailer

- Coupling device
- Tractor-trailer connections
  - Electric lines
  - Service and emergency air lines
  - Gladhands
  - Landing gear
  - Spare tire carrier
- Lamps and reflectors
- Trailer suspension
- Trailer axles, wheels, and tires
- Brake parts, including air tank
- Mud flaps
- Rear end protection device

READEX FICHE

LESSON 3 ORIENTATION TO THE TRACTOR-TRAILER (LAB)

Overview

Time Allotted: 1 hour

Prerequisites: Lesson 2 of Unit 1.1

Purpose:

This lesson is an instructor demonstration in which the key parts of a tractor-trailer are pointed out. The instructor should limit the demonstration to the objectives of the unit, i.e., simply identify the key components in a systematic way and state their functions. Detailed discussions of vehicle components occur in later classroom and lab lessons, particularly those in Units 1.2, 1.3, and 4.1. It may be helpful to refer to the instructor material in those units in order to inform students at what point in the course their more specific and detailed questions will be answered.

Materials

Instructional Aids

None

Student Material

Tractor-trailer Components Checklist, in Unit 1.1 of the Student Manual

Instructor Material

Instructor Aid #1 - Identification of Tractor-Trailer Components

A flashlight and a pointer to highlight vehicle components

Equipment

A 5 axle, tractor-trailer for demonstration. Preferably a cab-over-engine diesel tractor, which provides best possible view of all systems when cab is tilted forward.

Facilities

This lesson may take place on the range, in the shop, or another building depending upon weather conditions.

Content

Activity or Topic	Approximate Time
1. INSTRUCTOR DEMONSTRATION: TRACTOR-TRAILER COMPONENTS	1 hour

1. INSTRUCTOR DEMONSTRATION: TRACTOR-TRAILER COMPONENTS (60 minutes)

Purpose

The purpose of this exercise is to introduce the students to a tractor-trailer by identifying key systems and components in a systematic way. When necessary, briefly state the function. There is no evaluation of students in this exercise.

Layout

Set up the tractor so that it is not hooked up to the trailer but parked just in front of the semi-trailer so you can examine the fifth wheel assembly. Also, have the cab tilted or the hood open.

Directions

Preparation

- Divide the class into small groups of 4-8 students.
- Schedule each group to go through the lesson with a qualified instructor.

Instructor Demonstration: Tractor-Trailer Components (45 minutes)

Starting at the front of the tractor, proceed all around it pointing out the parts of the vehicle, then do the same with the semi-trailer.

Use the checklist "Identification of Tractor-Trailer Components" as a guide to the minimum components you should identify.

Answer questions as you present your demonstration (without getting too far ahead or into too much detail that will be covered in later lessons and/or cannot be absorbed now.)

Student Question and Answer Period (15 minutes)

Allow time for general questions about the identification and function of vehicle components. Avoid getting into detailed discussions that may confuse the students at this point. Keep in mind that more detailed discussions and demonstration lessons about vehicle components occur in later units, e.g., the identification and operation of vehicle controls occurs in Unit 1.2, identification of properly and improperly functioning components occurs in Unit 1.3, a detailed discussion of the operation of each vehicle system occurs via a series of demonstrations in Unit 4.1.

Notes:

Unit 1.1

INSTRUCTOR AID #1 - IDENTIFICATION OF TRACTOR-TRAILER COMPONENTS

Purpose

- o Identify key parts
- o Name the part
- o Briefly state its function
- o Answer questions

Sequence (This sequence will be used for pretrip inspection later on.)

1. Discuss tractor characteristics.

   Note tractor design
      Cab type, i.e., conventional COE, sleeper, etc.
      Axle characteristics, i.e., number of axles, live or dead axles
      Frame parts, i.e., side frame rail, crossmembers
      Engine types, i.e., gas, diesel
      Transmission type, i.e., manual, fully or semiautomatic, dual transmissions
      Type of fifth wheel, i.e., stationary, sliding

   Discuss what type of job this tractor was designed for.

2. Discuss trailer design, i.e., open, closed, length, type frame.

3. Identify key parts under the hood/cab.

   Oil and coolant level checkpoints
   Engine
   Radiator
   Cranking motor
   Fuel pump
   Filters
   Belts

4. Identify key cab parts.

   Sleeper berth
   Storage compartment
   Instrument panel
   Vehicle controls

5. Conduct a walkaround of the tractor while identifying these key parts.

   Front wheels
   Steering linkage
   Front suspension

- Brake parts
  - Drums or discs
  - Brake chambers
  - Slack adjusters
  - Air lines
- Air compressor
- Air tanks
- Fuel tanks
- Exhaust stack and muffler
- Intake stack and air cleaner assembly
- Batteries
- Air horns, lights and reflectors
- Coupling device
- Mud flaps
- Rear axles, wheels and tires
- Rear suspension
- Fifth wheel

6. Conduct a walkaround of the trailer while identifying these key parts.

   - Coupling device
   - Tractor-trailer connections
   - Electrical lines
   - Service and emergency air lines
   - Glad hands
   - Landing gear
   - Spare tire carrier
   - Lamps and reflectors
   - Trailer suspension
   - Trailer axles, wheels, and tires
   - Brake parts including air tank
   - Mud flaps
   - Rear-end protection

UNIT 1.2
CONTROL SYETEMS

UNIT 1.2 CONTROL SYSTEMS

PURPOSE

The purpose of this unit is to introduce students to vehicle instruments and controls.

OBJECTIVES

Performance Objectives

Students must be able to identify each of the vehicular driving controls and the various monitoring devices (gauges, alarms, lights, etc.) required to operate the vehicle safely and efficiently.

Knowledge Objectives

Students must know

- the name, location, and function of each of the primary controls including those required for steering, accelerating, shifting, braking, and parking.
- the name, location, and function of each of the secondary controls including those required for control of lights, signals, windshield wipers and washers, interior climate, engine starting and shutdown, suspension and coupling.
- the name, location, function, and the acceptable reading range of the various instruments required to monitor vehicle and engine speed as well as status of fuel, oil, air, cooling, exhaust, and electrical systems.

Skill Objectives

None

Attitude Objectives

Students must believe that

- monitoring the instrument panel for early warning of malfunctions is a basic requirement for safe and efficient operation.
- instruments can and will malfunction and that the displayed information can and must be augmented by information from other sources.

LESSONS

Lesson 1.	**Introduction to Vehicle Instruments and Controls (Classroom)**	**1 hour 45 minutes**
Lesson 2.	**Instrument and Control Familiarization (Lab)**	**45 minutes**

LESSON 1 INTRODUCTION TO VEHICLE INSTRUMENTS AND CONTROLS (CLASSROOM)

Overview

Time Allotted: 1 hour 45 minutes

Prerequisites: Unit 1.1

Purpose:

The purpose of this lesson is to introduce the students to the commonly used controls and instruments in a truck-tractor. The discussion of instruments includes the function and normal operating range of common truck-tractor instruments, the importance of instrument monitoring and the consequences of ignoring warning from instruments. The normal operating range of vehicle pressure and temperature gauges varies by type of engine, equipment and maintenance department requirements. As such, the examples in the lesson show a wide range of readings. Stress that on the job proper readings must be obtained from factory-prepared Operators' Manuals or from the maintenance department. Use the range of safe operating readings from your school's training vehicles as examples.

NOTE: KEEP IN MIND THAT THE PURPOSE OF THIS LESSON IS THE BASIC FAMILIARIZATION WITH THE SUBJECT. HENCE THE RELATIVELY SHORT PERIODS OF TIME ALLOCATED. QUESTIONS SHOULD BE HELD TO A MINIMUM AS THESE SUBJECTS WILL BE COVERED IN DEPTH IN SUBSEQUENT UNITS.

Materials

Instructional Aids

Visuals 1 - 20

Student Material

Identification of Vehicle Controls and Instruments, in Unit 1.2 of Student Manual
Review Quiz, in Unit 1.2 of Student Manual

Instructor Material

Operator's and Service Manuals for vehicles used in the school
Review Quiz, for Unit 1.2 in the Student Manual

Content

Activity or Topic	Approximate Time
1. FUNCTION AND OPERATION OF VEHICLE CONTROLS	45 minutes
2. PURPOSE AND FUNCTION OF VEHICLE INSTRUMENTS	30 minutes
3. SUMMARY AND REVIEW	30 minutes
	1 hour 45 minutes

1. FUNCTION AND OPERATION OF VEHICLE CONTROLS (45 minutes)

Vehicle Controls

Devices to operate the vehicle
Driver responsible to learn function of all controls before operating any vehicle

Three Types of Controls on a Tractor-Trailer

Engine Controls
Controls required to start and shut down engines
Don't control movement of vehicle

Primary Vehicle Controls
Controls related to vehicle movement
EXAMPLE: accelerator pedal, steering wheel, transmission controls and brake controls

Secondary Controls
Controls not related to vehicle movement
EXAMPLES: light switches, climate control and controls related to starting and stopping the engine

Visual 1 In Cab View

Engine Controls

Controls similar in most vehicles

Variation depends on type of engine
- Gasoline, diesel or LPG type
- Type of diesel, e.g., Caterpillar, Cummins, Detroit, Mack
- Type of starter--electrical or air starter

Engine Control Switch

Basic switch to energize circuits
Three-position operation (on-off-accessory) like most automobiles
"On" position energizes starting circuits
- Gasoline engine--ignition
- Diesel engine--electric starting solenoid and/or electronic fuel cut-off switch

Hand Throttle (if so equipped)

Function

Manually controls engine speed (rpm)
Pulled out or upward to increase engine speed
Knob turned to lock engine speed at desired rpm

Starter Button

Momentary on/off switch located on console
Push in to crank the engine

Auxiliary Starter Button

  Available on some COE models to start engine with cab tilted

Engine Stop Control Knob--used on some diesel engines

  Starting engine--pushed in "on" or "running" position
  Shutting down the engine
    Held all the way up until engine is completely stopped
    Remains in "stop" position until engine is started again

Compression Release Valve--used on some engines

  Reduces engine compression mechanically for reduced load on engine cranking motor

Emergency Engine Stop Control

  Pulled out to shut down the engine emergency situations only
  Cuts off air supply to engine (in some Detroit diesel engines)
  Must be reset by mechanic once used

Primary Vehicle Controls

Accelerator Pedal

Operates like automobile
Depressed to increase speed
Released to reduce speed

Steering Wheel

Larger steering diameter than car, usually 20" to 22"
  Provides increased leverage to help driver overcome resistance
  Requires more effort than steering wheel on car
  Can be as much as 8 full revolutions for full right to full left turn instead of 2-1/2 for car

Types and Adjustments

  Power and nonpower steering available
  Steering wheel can be adjusted up or down, in or out, tilted, on some vehicle models.

Clutch Pedal

Used when cranking engine and shifting gears
Three basic clutch positions

Free play

- Amount of movement of clutch pedal without disengaging clutch
- Not less than 1/2" or more than 2-1/2"

Engaged

- Clutch pedal released, e.g., driver's foot not on it
- Engine and drive train connected

Disengaged

- Clutch pedal depressed
- Engine and drive train separated
- Used for cranking engine and shifting gears
- Cranking engine
  - Disengage clutch by depressing so that transmission countershaft will not have to be turned over, thus robbing cranking power
- Shifting gears
  - Operate in quick strokes to avoid excessive rpm drops between gears
  - Double clutching used for timing and to acquire correct rpm

Visual 2 Clutch Brake Operation

Clutch Brake (some tractors)

- Some nonsynchronized transmissions have clutch brake
- Stops or slows down transmission input shaft and countershaft
- Used only to engage first or reverse gears when vehicle is standing still
- Engage clutch brake only when truck is not moving
- Only engaged in last inch of clutch pedal down stroke
- Should not be engaged during downshifting or upshifting
- Avoid clutch brake contact by using shallow clutch strokes 3 inches)

Safe Operation of Clutch

- Extensive damage to drive train or to clutch can occur if not operated properly
  - Do not "snap" clutch (engage too rapidly)
  - Never, ever use as foot rest (even lightly)
  - Operate clutch brake properly

Visual 3 Automatic, Semiautomatic, Manual Transmission Gearshift Levers

Transmission Controls

Depends on type of transmission
Automatic transmissions do not use clutch, just selector gear

Manual transmissions use clutch and gear shift lever
Combination transmissions, e.g., main auxiliary or main and variable speed rear-end, have more controls to deal with

Automatic Transmission

- Fully automatic transmission
  - All shifts made without interruption of power to wheels
  - Driver selects range of gears wanted with selector gear
  - All shifting in that range done for driver
  - Vehicle not equipped with a clutch
  - EXAMPLE: Driver selects D (Drive) or 2-5 range for normal driving conditions.
  - Driver must recognize conditions and select the proper range
- Semiautomatic transmissions (sometimes called powershift)
  - All shifts made without interruption of power to wheels
  - Driver shifts gear but no clutch used
  - Gearshift lever has notch for each transmission speed
  - Driver has to recognize when to change gears based on engine rpm, driving conditions, etc.

Manual Transmission

- Operates similar, to car manual transmission
- Usually between 4 and 10 forward speeds
- Can be synchronized or nonsynchronized type
- Driver operates with clutch pedal and gearshift
  - Must learn when and how to shift gears

Visual 4 Main and Auxiliary Gearshift Levers and Patterns

Manual Transmission Combined With Auxiliary Transmission

- Two gearshift levers--one for each transmission
- Requires much skill and experience to shift properly
- Examples of main and auxiliary transmissions:
  - 4 x 3 transmission--12 forward speeds
    - Main gearshift has four forward speeds
    - Auxiliary gearshift has three speed ratios--under, direct and over
  - 5 x 3 transmissions--15 forward speeds
    - Main gear shift has five forward positions
    - Auxiliary gearshift has three speed ratios--under, direct and over
  - 5 x 4 transmission--20 forward speeds
    - Main gearshift lever has five forward position
    - Auxiliary gearshift has four speed ratios--low, under, direct and over

Visual 5 Controls and Operation of a 13 Speed Roadranger

Main and Auxiliary Transmissions With Single Gearshift Lever

EXAMPLE: 13-speed roadranger with only one shift lever but has range selector and splitter switch

Range selector
- Low position for first through 4th gears
- High position for 5th through 8th gears

Splitter valve
- Located at top of gearshift lever
- Serves function of auxiliary gearshift lever

- Can be changed to select low, direct or overdrive gear ratios Direct or overdrive creates additional forward speeds
  - Splits 5th through 8th to direct and overdrive
  - EXAMPLE: 5th direct, 5th overdrive, 6th direct, etc.
- Low creeper gear also available
  - Gearshift in lowest gear
  - Range selector in low range
  - Splitter flipped to direct position

Visual 6 Shift Controls for 2 Speed Rear Axle

Main Transmission With 2 or 3 Speed Rear Axles

- Variable rear axle ratios provide more gear reductions
- Two speed rear axle converts a 5 speed transmission into 10 forward speeds
- Gearshift lever used for main transmission gear changes and button or other control used to shift rear-axle speed

Visual 7 Foot and Hand Brake Controls

Brake Controls--Air Braking System

Foot Brake Control Valve (also called foot valve or treadle valve)

Function
- Operates service brakes in tractor and trailer
- Depressed to open valves and send air pressure to brake chambers
- Applies pressure equally to all tractor and trailer service brakes

Feel of Brakes
- Operates similar to car footbrakes (hydraulic system)
- Feel of treadle valve is quite different - car type creates energy as pedal is depressed, this type releases stored energy
- Operation reversed--use more pedal pressure and then less as vehicle speed reduced

Trailer Brake Control Valve (also called hand valve, trolley valve or independent trailer brake)

- Operates service brakes on trailer only
- To be used in special situations only

Caution: Not designed to hold equipment when parked

NOTE: In this curriculum, the trailer brake may be referred to as the independent trailer brake control to distinguish it from the trailer-brakes activated by the foot brake.

Parking Brake Control Valve

Most tractors use spring brakes operated by dash-mounted control
Can be a flip switch or push-pull knob
Caution: Should only be applied after tractor is fully stopped

Visual 8 Tractor Protection Valve and Emergency Trailer Brake Operation

Emergency Trailer Braking Controls and/or Parking Brakes

Tractor Protection Valve

Controls compressed air supply to the trailer brakes only
Must be
  Open for normal operation with trailer
  Closed (off) for operation of tractor without trailer

Normal operation
  Two-way switch located on dashboard
    Open position--provides air supply to trailer brakes

    Closed position--closes off air supply to trailer
Trailer brakes will be applied by trailer relay valve

Emergency function
  Closes automatically if air supply drops while driving (approximately 20 to 45 psi)
    Protects tractors air supply by stopping outflow of air
    Opens emergency relay valve which applies trailer brakes
    Results: Sudden stop of trailer could be dangerous
      Driver could lose control easily on curves, wet roads

Tractor protection valve must never be used as parking brake

Trailer emergency relay valve
  Functions only during an emergency (lost air supply) only
  Crossed air lines cause it to keep brakes applied
  Can't be counted on to hold brakes applied on a parked trailer

Trailer Spring Loaded Brakes

Many trailers now equipped with spring brakes on trailer axles

Nonemergency application
  Applied automatically when trailer air pressure to air pressure to trailer is shut off and/or when trailer unhooked

Used as parking brake
Keeps trailer from rolling

Emergency application
Automatically applied when air pressure drops below a certain psi level and/or when air line breaks, i.e., when emergency trailer braking system triggered by tractor protection valve

Visual 9 Example and Operation of Front Brake Limiting Valve

Other Primary Controls Available in Some Vehicles

Front Wheel (Steering Axle) Brake Limiting Valve

An option found on some tractors

Purpose and Use
Limits amount of braking force on front axle brakes
Usually reduces braking force approximately 50 percent
Helps prevent wheel lock-up on wet/slippery roads
NOTE: This is only on vehicles not having FMVSS-121 type brakes

Operation
Two-way switch located on instrument panel (NOTE: may be an automatic valve action)
"Dry road" position--air pressure to front wheels is not being reduced
"Slippery road" position--air pressure is being reduced

Visual 10 Types of Engine Brake Controls and Principles

Auxiliary Brakes or Speed Retarders

Auxiliary brakes reduce the vehicles forward motion without using service brakes
Reduces burden upon primary brake system
Keeps service brakes from being overused and/or overheated
There are four basic classifications of auxiliary brakes or speed retarders

Exhaust Brakes
Considered simplest form of heavy-vehicle retarder
Contains a butterfly valve installed in exhaust manifold that
Cuts off escaping exhaust gasses
Builds up back pressure in engine preventing it from increasing speed
Usually has
An on-off control switch in cab
Automatic control switch on accelerator and/or clutch
EXAMPLES: Williams Air Controls--"Blue Ox"
Mercedes Trucks--"Exhuast Brake"

Engine Brakes
- Probably most widely used type of retarder
- Is built into head of engine
  - Alters valve timing
  - Turns engine into air compressor
- May be operated
  - Manually using a dash-mounted switch
  - Automatically preselected to cut in when foot is taken off accelerator pedal
- EXAMPLES: Jacobs Manufacturing Company - "Jake Brake"
  Mack Truck "Dynatard"

Hydraulic Retarders
- Are one type of drive line retarder
- Usually mounted between engine and fly wheel
- Uses oil directed against vanes in a stator to slow vehicle
- May be activated manually or atuomatically (e.g., hand lever in cab, and/or accelerator switch on floor of cab)
- EXAMPLES: Caterpillar Tractor Company--"Cat Brake Saver"
  Detroit Diesel Allison--"Allison's Integrated Retarder"

Electric Retarders
- Another type of drive line retarder
- Contains electro-magnets
- Magnets exert a retarding force on rotors attached to drive line
- Operated by a manual control switch in cab
- EXAMPLES: Jacobs Manufacturing Company--"Jake ER Brake"
  Francoise Telma--"Telma Retarder"

Visual 11 Interaxle Differential Lock Controls: Principles and Operation

Interaxle Differential Lock Control

Location and Purpose
- Locks and unlocks rear tandem axles
- Unlocked position--Normal to allow axles to turn independently of each other on dry surface
- Locked position--Equalizes power in axles to help prevent wheels lacking traction from spinning
- Never operate in locked position longer than absolutely essential

When Used

- For extra traction on wet, icy or muddy surfaces
- Before wheels spin or when spinning is completely stopped

Operation: Locking interaxle differential

- Provides power to the drive axles
- Two types of operation
    - Most older models--stop vehicle before locking up interaxle differential
    - Some newer models--switch to lock position while maintaining vehicle speed
    - All models
        - Do not lock when wheels are spinning, will cause severe damage
        - Do not make sharp turns while locked as severe damage can occur

Visual 12 Types of Truck-Tractor Secondary Controls

Secondary Vehicle Controls

- Variety of secondary controls
- Many similar to automobile, e.g., lights, windshield wipers, turn signals
    - However, many turn signals do not cancel automatically
- Others peculiar to truck tractor, e.g., hydraulic cab tilt operation, 5th wheel slider controls
- Number and kind varies based on
    - Vehicle design, e.g., COE or conventional
    - Options and equipment available

Types of Secondary Controls

- Related to following major categories
    - Mechanical systems not related to driving
        - Hydraulic cab tilt operation
        - Fifth wheel lock controls
    - Seeing
        - Light switches
        - Windshield wipers
        - Defroster
    - Communication
        - Horns
        - Radio
        - Lights
            - Headlights
            - Brake lights
            - 4-way flashers
    - Climate controls
        - Heater
        - Air conditioner
    - Comfort controls
        - Seat position control
        - Air vents
    - Driver safety
        - Seatbelts

Visual 13 EXAMPLE: Controls and Steps in Hydraulic Cab Tilt Operation

Operation of Secondary Controls

EXAMPLE: Hydraulic cab tilt operation

- Necessary for safety
    - Engine shut off
    - Transmission in neutral
    - Cab cleared of loose objects
    - Brakes set and/or wheels chocked
- Operation
    - Release safety lock
    - Release locking arm and/or pin
    - Work hydraulic pump to tilt cab to desired angle
    - Put safety rod in place to prevent cab from accidently returning to normal position

Visual 14 EXAMPLE: Air Suspension Seat Controls

- Many varieties of seat controls
- Model illustrated "Level Air II"
    - Has automatic squeeze lever adjustment
    - Air control lever instantly adjusts to different driver weight
    - Rotation of lever provides correct height adjustment

Driver's Responsibility to Learn Operation of all Secondary Controls

- Learn function and operation of all secondary controls before operating a vehicle
    - By demonstration from instructor or other driver
    - Through instructions in the factory supplied operator's manual

2. PURPOSE AND FUNCTION OF VEHICLE INSTRUMENTS (30 minutes)

Importance of Instruments

Monitor operating conditions of vehicle
Warn driver of impending problems

Instrument Reading When Engine is Warming

- Must recognize when vehicle has reached safe operating range, e.g., when air brake reservoir pressure, oil pressure readings, and water temperature are okay

Instrument Readings When Operating the Vehicle

Must recognize what instruments tell the driver, e.g., tachometer readings indicate need to shift to avoid lugging, temperature and pressure gauges indicate improper and/or unsafe operating conditions

Driver Responsibilities for Learning About Instruments

Before driving a vehicle, must understand instruments
- Function and purpose of each vehicle instrument
- Proper and improper readings at various conditions, e.g., idling, full load
- Meaning of improper reading and action to take

Visual 15 Basic Instruments: Speedometer, Fuel Gauge, Tachometer

Basic Instruments

Speedometer

Required by law
Shows speed in miles per hour
Not always accurate

Odometer

Indicates number of miles traveled

Tachometer

Shows engine speed in rpm (hundreds)
Guide for shifting and selecting various transmission speeds
- Rpm readings vary according to engine model
- Driver must learn idle speeds and governed speeds of vehicle he operates

Fuel Gauge

Indicates amount of fuel in tanks
Estimates--not always accurate
Driver checks tanks visually before each trip

Visual 16 Measuring the Electrical System

Voltmeter

Measures the battery charging voltage
13-15.5 is normal reading or range specified in operator's manual

Ammeter

Measures the amount the battery is being charged or discharged
Some vehicles have warning light only
Some gauges may say alternator instead of ammeter

- Normal operating range
  - Engine off--reading is zero
  - Engine starts--needle jumps to charge side and flutters
  - Warmed engine--zero or slightly on charge side

- Problems indicated by continuous high charge or discharge
  - Continuous high charge: battery on verge of failure
  - Continuous discharge: battery not receiving charge from alternator

- Many possible causes, e.g.,
  - Battery needs fluid
  - Voltage regulator malfunction
  - Bare wire causing shorts
  - Defective alternator

Visual 17 Basic Pressure Gauges and Readings

Pressure Gauges

Measure air and oil pressure in psi

Importance of Pressure Gauges

- Air pressure and oil pressure gauge are two of most important gauges
- Improper indications should be checked out immediately
  - If lubrication is lost engine can be destroyed very rapidly
  - If air pressure is dropping, get vehicle off road immediately before emergency valves react and stop the vehicle abruptly in middle of road

Air Pressure Gauge

- Measures air pressure in reservoir (tanks)
- Do not operate vehicle without sufficient air pressure
  - Know what your vehicle's proper range is e.g., 85-105, 100-120, 105-125, etc.
- Proper operating range
  - Starts building as soon as engine starts
  - Should continue to build until maximum pressure is reached (95-120 psi)
  - Should operate only with maximum pressure

- Improper operating range
  - Air pressure does not build up when engine starts (if reservoir not full)
  - Excessive loss when brakes applied
  - Gradual or sudden loss during operaton
    - Approximately 60 psi is warning level for operator to act
    - Approximately 20 to 45 psi activates trailer emergency brakes
    - Also activates tractor spring brakes (if so equipped)

Causes of inadequate air pressure
  - Problems with air braking system, e.g. air leaks, compressor failed, air lines broken or kinked, or lines connected incorrectly, air tank petcock open

Identify and correct problems
  - Unsafe to operate with inadequate air pressure
    - Stop immediately
    - Locate source of problem
    - Get it corrected

Oil Pressure Gauge

Measures adequacy of engine lubricating oil pressure

Proper lubrication is necessary to reduce friction between fitted parts (e.g., pistons, cylinders)

Oil pressure should register within seconds after engine is started and gradually rise to normal operating range

Normal operating range depends on specific vehicle and engine rpm, e.g., 5-20 psi when idling, 35-75 psi at operating speeds

Drivers should stop and investigate
  - If pressure does not register or fluctuates back and forth rapidly when starting
  - If sudden or gradual loss in pressure below normal operating range

Typical Problems and Causes
  - Low oil level and possible oil leak or oil pump failure
  - Adequate oil level and no leaks indicate probable oil pump problem Plugged oil filter or plugged line

Other Pressure Measuring Gauges

Vehicles can display
  - Coolant pressure
  - Tire pressure
  - Clutch fluid pressure
  - Fuel pressure
  - Manifold pressure
  - Turbo pressure
  - Air brake application gauge

Drivers should refer to operators manual for proper and improper ranges and consequences.

Visual 18 Basic Temperature Gauges and Readings

Temperature Gauges

Monitoring of temperature needed to avoid operating engine at temperatures that are too high or too low.

Not letting engine warm up properly can also cause damage

A driver should

- Give engine a chance to warm up to operating temperatures before applying full load
- Monitor temperature gauges while operating for indications of overheating or running too hot
- Shut down overheating engine at once

Coolant Temperature Gauge

- Measures temperature of water or coolant in engine block
- Normal operating range--engine should be operated at 170-195 Farenheit (or safe range indicated by Operator's Manual)
- Normal operation--when engine and coolant are cold thermostat is closed and fluids circulate through engine only and heats up very quickly
- Thermostat opens when temperature reaches designed range and coolant flows through radiator
- Overheating can be caused by
    - Aereation or insufficient coolant
    - Loose or broken fan belt
    - Improperly functioning thermostat, coolant pump, radiator shutters
    - When engine is under severe load (pulling) condition

Engine Oil Temperature Gauge

- Measures engine oil temperature
- Normal range approximately 20-60° higher than water temperature
- Normally runs at 180-225°, could run as high as 250-265° with full load for a short period of time (or safe range indicated by Operator's Manual)
- Related to oil pressure, high oil temperatures cause thinner oil and decrease in pressure, at normal oil temperatures, oil pressure should normally be 40-60 pounds
- Engine should not be operated over safe operating range (as shown in operator's manual)

Other Temperature Gauges

Some vehicles contain additional temperature gauges, depending on type of equipment, etc.

Exhaust Pyrometer Gauges

- Indicates temperature of exhaust gases at exhaust manifold
- Excessive exhaust temperature could harm turbocharger
- Maximum operating conditions may be shown on name plate of the pyrometer glass (or check operators manual)
- Sometimes used to monitor proper gear position--lugging engine will cause high temperature

Gear Box Temperature Gauge

- Measures temperature of lubricant in transmission
- Normal reading 150-200°
- High readings indicate clutch abuse or improper adjustment (slippage) or low oil level

Axle Temperature Gauge

- Measures temperature of lubricant in front and rear drive axles
- Normal reading loaded or unloaded is 150-200
  - Intermittent readings of 230-250 are okay
  - Readings should be within 10° of one another
  - Readings above the normal range indicate bad bearings or flat tire
- Forward rear axle in a twin-screw will run hotter than the rear axle

Visual 19 Types of Warning Devices

Warning Devices

Vehicles are also equipped with warning lights or buzzers to indicate when fuel or air pressure or temperature has reached danger point

Telltale panels

Some vehicles have basic warning lights on telltale panel

Lights normally off on panel but will light up and/or flash to indicate malfunction

Vehicle should not be operated when warning devices indicate a malfunctioning system

Basic Warning Lights or Buzzers

Low air warning pressure alarm and/or light indicates inadequate pressure in air brake system

Coolant level alarm lights up when water level starts dropping, indicating probable leak

Oil level alarm lights up when oil level becomes too low for normal operation

Coolant temperature warning lights up when temperature becomes too high for normal operation

Oil pressure warning lights up when oil pressure becomes too low for safe operation

Pyrometer warning lights up when exhaust temperatures are abnormal

Differential warning flashes when interaxle differential is in "locked" position

Visual 20 Tachograph: Example and Uses

Tachograph

Optional recording instrument that provides record in chart form for every hour whether vehicle is parked or running

Indicates by Time of Day

Whether engine is running, idling, or stopped
Rpm of engine
What gear the driver was in at given moment and how long it took him/her to get through a town
Actual road speed at any given time

Purpose

Helps truck company analyze safety and economy of runs
Legal protection--the chart is evidence that shows speed and other details during an accident
As an aid to fuel efficiency, points out poor driving habits such as long idles when engine should have been stopped, over revving, and erratic speeds

3. SUMMARY AND REVIEW (30 minutes)

Review Quiz

Review quiz in Student Manual, Unit 1.2
Allow time for students to complete review quiz for Unit 1.2 and discuss answers, or use the quiz as a group exercise and call on students randomly
A copy of the review quiz starts on the next page

Summary Points

Important to learn safe operating readings on instruments for all vehicles students will drive

When engine is warming up

When engine is operating

Instrument monitoring is a skill
    To be learned as the course progresses
    To be learned on the job

Instrument monitoring should be combined with the senses to make a safe driver, e.g., what he sees, hears, smells and feels when driving

Important to act before a problem occurs
Professional drivers must constantly monitor vehicle systems condition to enable them to avoid damage to vehicle and/or avoid accidents

Instruments and Controls of Vehicles Used at This School

Inform students that vehicle controls/instruments will be demonstrated to them on the vehicles used in this school
Describe instruments/controls specific to school vehicles

Notes:

UNIT 1.2 - REVIEW QUIZ

To be completed in class.

PART A

Match the control or instrument in Column A with the best identification in Column B.

COLUMN A	COLUMN B
____1. Tachometer	A. Normally in "unlocked" position to allow axles of tandem to turn independently.
____2. Tachograph	B. Prepares a chart that shows activity of vehicle.
____3. Tractor protection valve	C. Uses engine compression to slow speed of the vehicle.
____4. Interaxle differential lock control	D. Measures temperature of engine exhaust.
____5. Pyrometer gauge	E. In "emergency" position activates trailer brakes.
____6. Exhaust brakes	F. Measures engines rpm

PART B

Read the description of each situation and answer the questions.

The air pressure is dropping. It reaches 60 psi and the low air warning device goes on. The air pressure continues to drop gradually.

1. What does this indicate?____________________________

2. What should you do?____________________________

3. What will happen if you don't act fast?____________________

The engine oil temperature is rising gradually. It is out of the normal range. At the same time, oil pressure is gradually dropping and it is below the normal range.

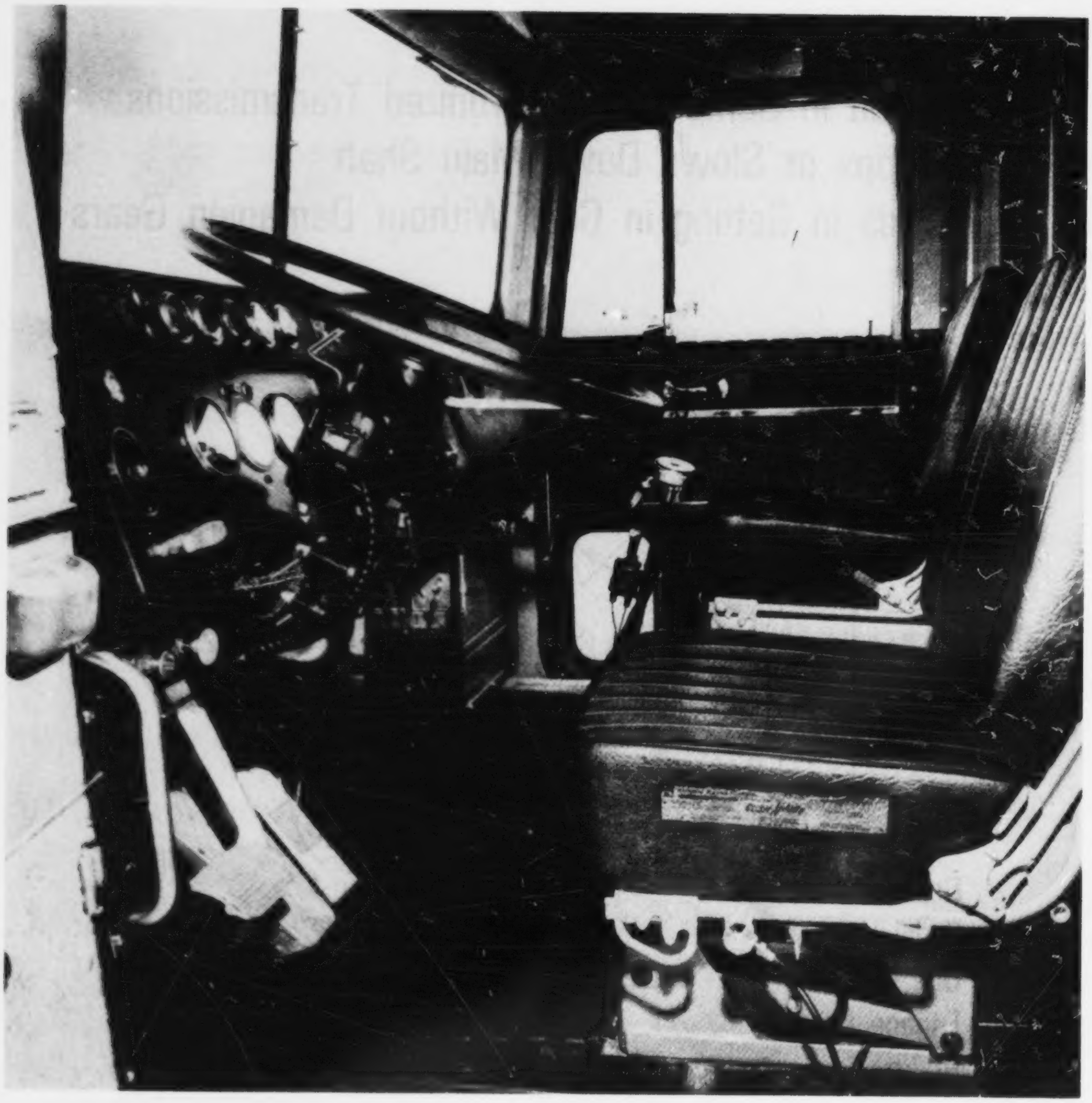
1. What does this indicate?____________________________

2. What should you do?____________________________

3. What will happen if you fail to act?____________________

Visual 1

In Cab View of Controls

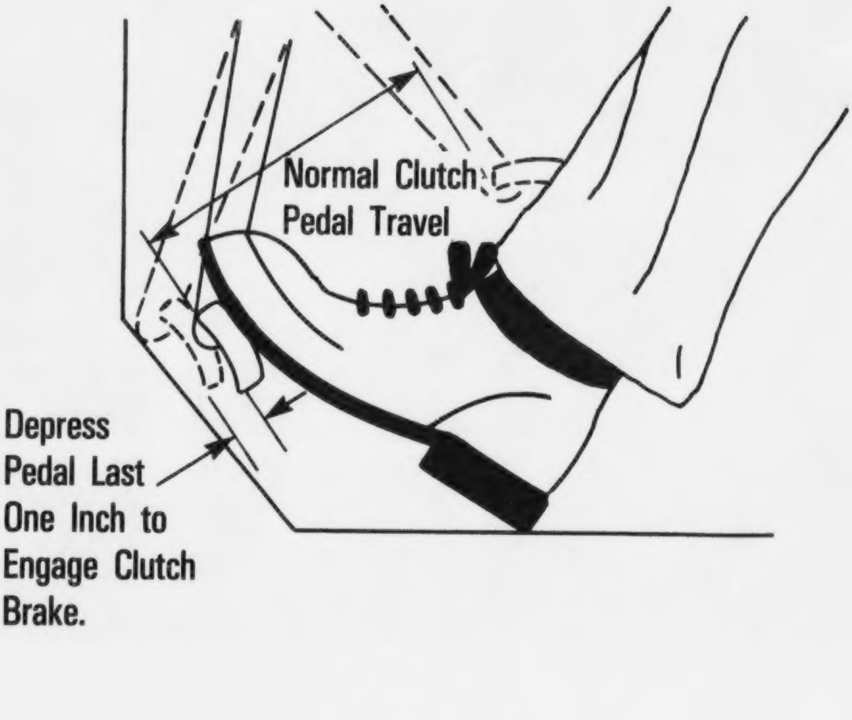


Visual 2

Clutch Brake Operation

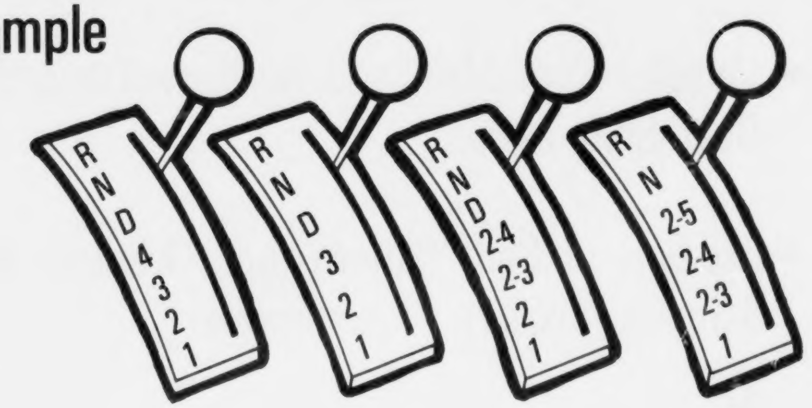
- Clutch Brake
  - – Used in Some Nonsynchronized Transmissions
  - – Stops or Slows Down Main Shaft
  - – Aids in Getting in Gear Without Damaging Gears

Operation

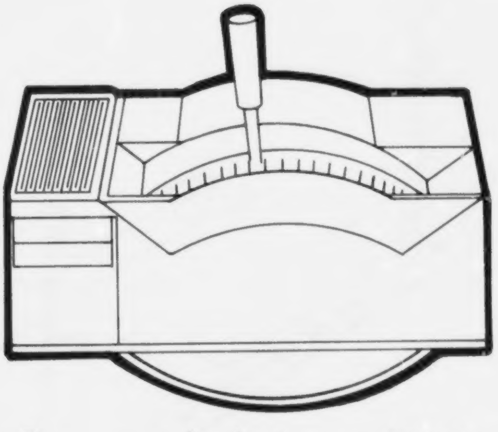

Normal Clutch
Pedal Travel
Depress
Pedal Last
One Inch to
Engage Clutch
Brake.

Automatic, Semi-Automatic, Manual Transmission Gearshift Levers

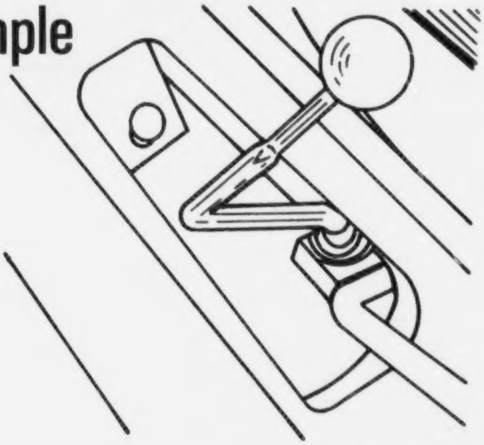
Automatic Example


R N D 4 3 2 1
R N D 3 2 1
R N D 2-4 2-3 2 1
R N 2-5 2-4 2-3 1

Semi-Automatic Example



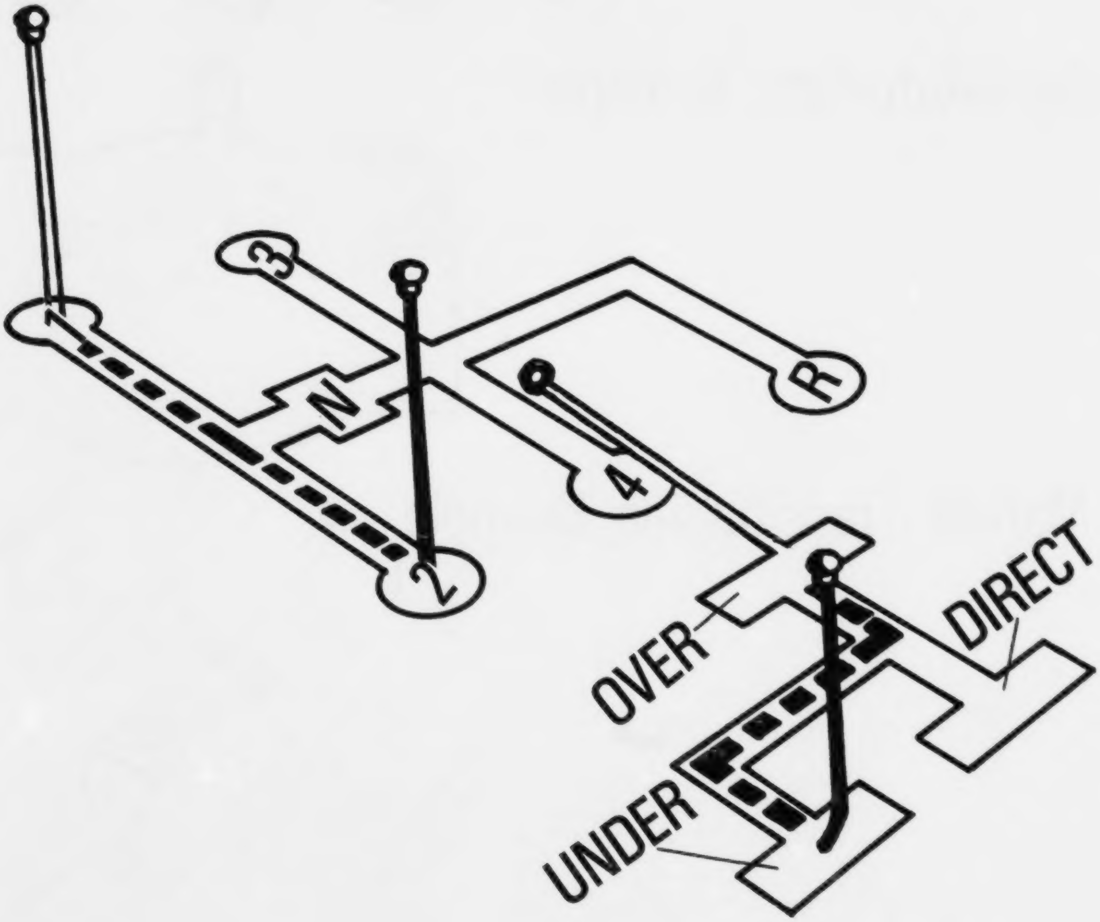
Manual Transmission Example



Main and Auxiliary Gear Shift Levers and Pattern

- Vehicles With Main and Auxiliary Transmission Have Two Gear Shift Levers

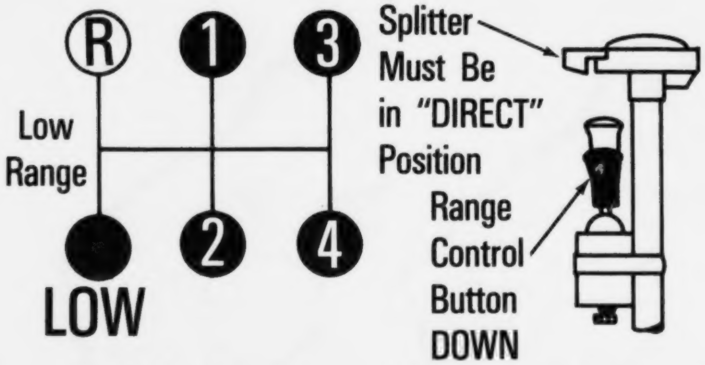
- Example of Shift Pattern for a 4-Speed Main Coupled With a 3-Speed Auxiliary Transmission


3
N
R
4
2
1
OVER
DIRECT
UNDER

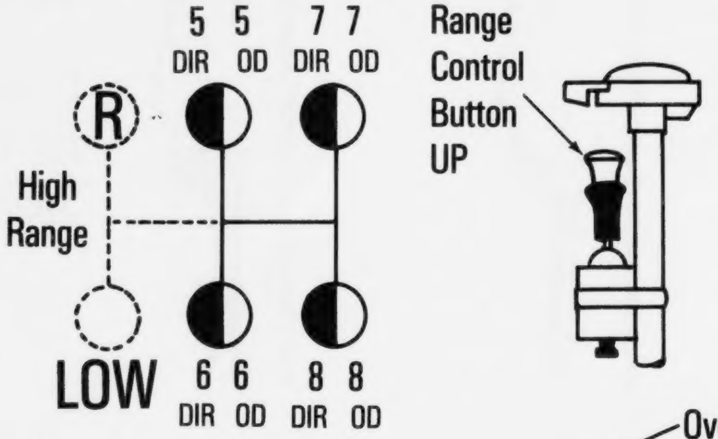
Visual 5

Controls and Operation of a 13-Speed Roadranger

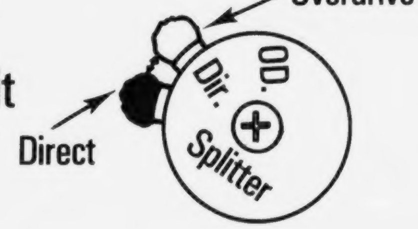
While in Low Range, Shift This Pattern ...


R
1
3
Low Range
LOW
2
4
Splitter Must Be in "DIRECT" Position
Range Control Button DOWN

While in 4th Speed of Low Range, Pull Up Range Control Button, and Shift This Pattern ...


5 DIR
5 OD
7 DIR
7 OD
R
High Range
LOW
6 DIR
6 OD
8 DIR
8 OD
Range Control Button UP

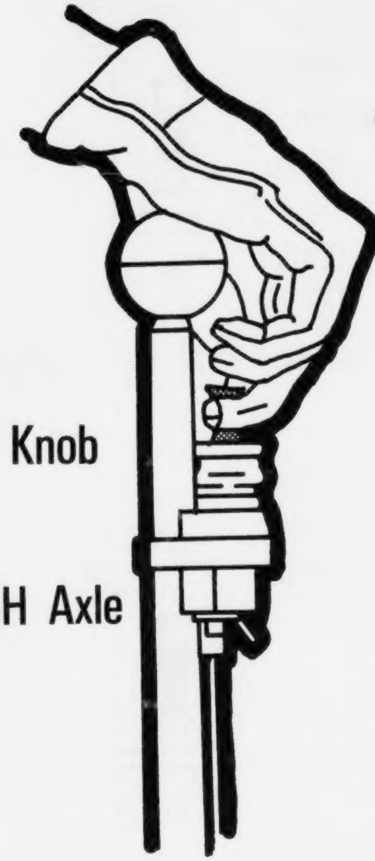
... Using Splitter Valve to Split the High Range Ratios ...


Overdrive
Direct
OD.
Dir.
Splitter

Visual 6

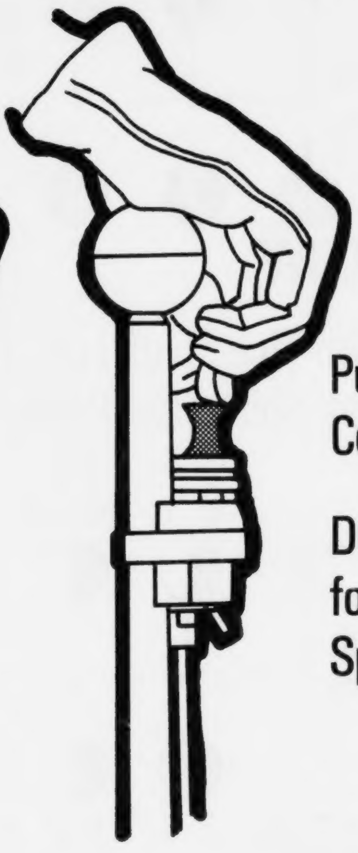
Shift Controls for 2-Speed Rear Axle

Shift Control for 2-Speed Axle



Pull
Control Knob

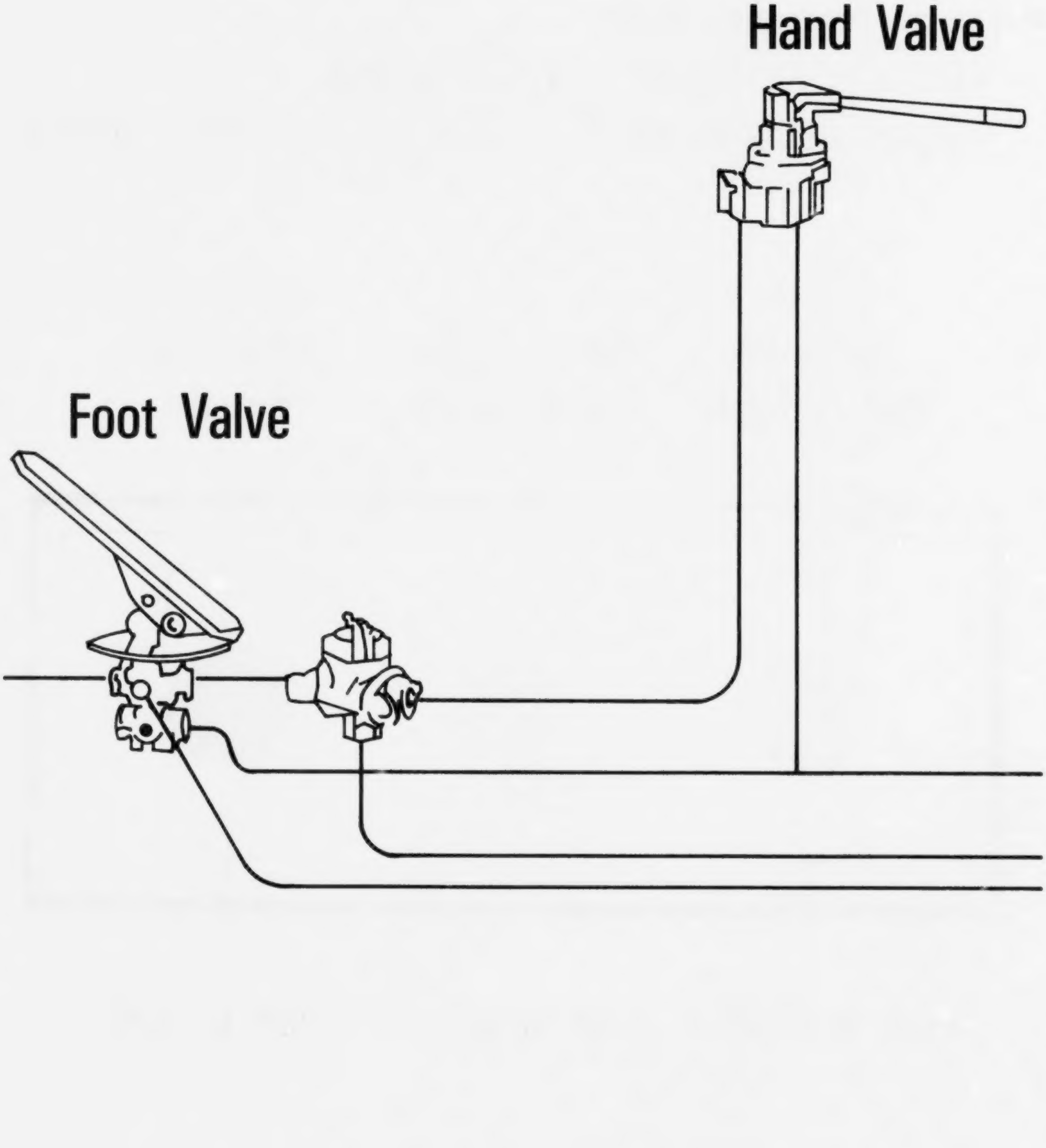
UP
for HIGH Axle
Speed



Push
Control Knob

DOWN
for LOW Axle
Speed

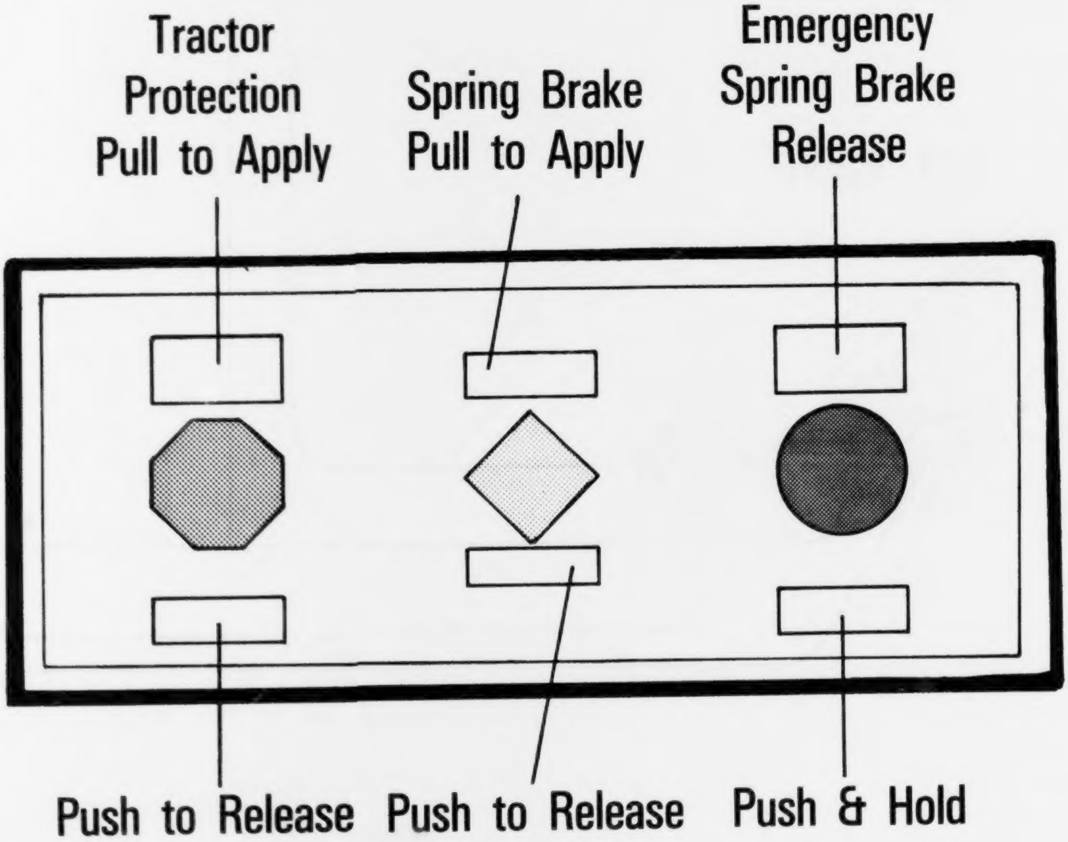
Foot and Hand Air Brake Controls


Hand Valve
Foot Valve

Visual 8

Tractor Protection Valve and Emergency Trailer Brake Operation

- Tractor Protection Valve
  - – Provides Air Supply to Trailer Brakes
  - – Closes Automatically if Air Supply Drops When Driving


Tractor
Protection
Pull to Apply
Spring Brake
Pull to Apply
Emergency
Spring Brake
Release
Push to Release
Push to Release
Push & Hold

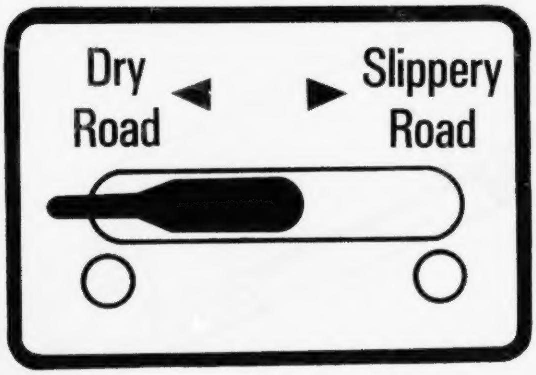
Front Brake Limiting Valve

- Available on Some Vehicle Equipped With Front Axle Brakes
- Limits Amount of Braking Applied to Front Axle Brakes

Operation

Dry Road Position—The Limiting Valve Not Operating

Slippery Road Position—Keeps Front Axle Brakes From Applying Full Force

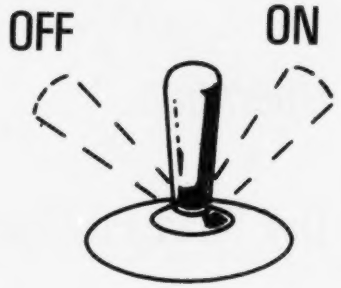


Visual 10

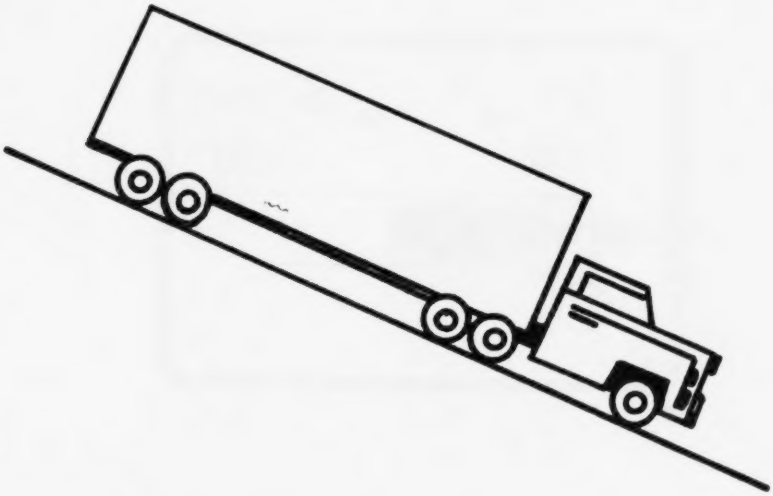
Engine Brake Controls

- Engine Brakes Supplement Service Brakes
  - –Reduce Power or Interrupt Cycle to Cause Braking Action

Example: Jacobs Engine Brake



- System Normally "off"
- System Activated
  - –Toggle Switch Turned On
  - –Driver Releases Foot From Throttle
- Used for Long, Dry Down Hill Runs



Don't Use in the City Because of Noise!

Visual 11

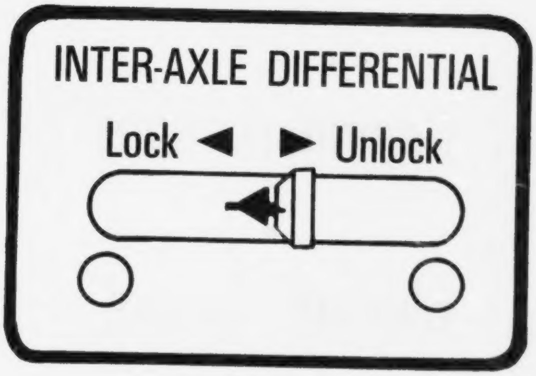
Interaxle Differential Lock Control

Function

- Tandem Axles Rotate Independently
- They Can Be "Locked" to Reduce Wheel Spinning on Slippery Surfaces
- Operated by Lock Control on Dash

Unlock—Normal Position

Lock—Wheels Have to Be Locked Before Driving on a Slippery Surface and Before They Spin


INTER-AXLE DIFFERENTIAL
Lock ◄
► Unlock

Visual 12

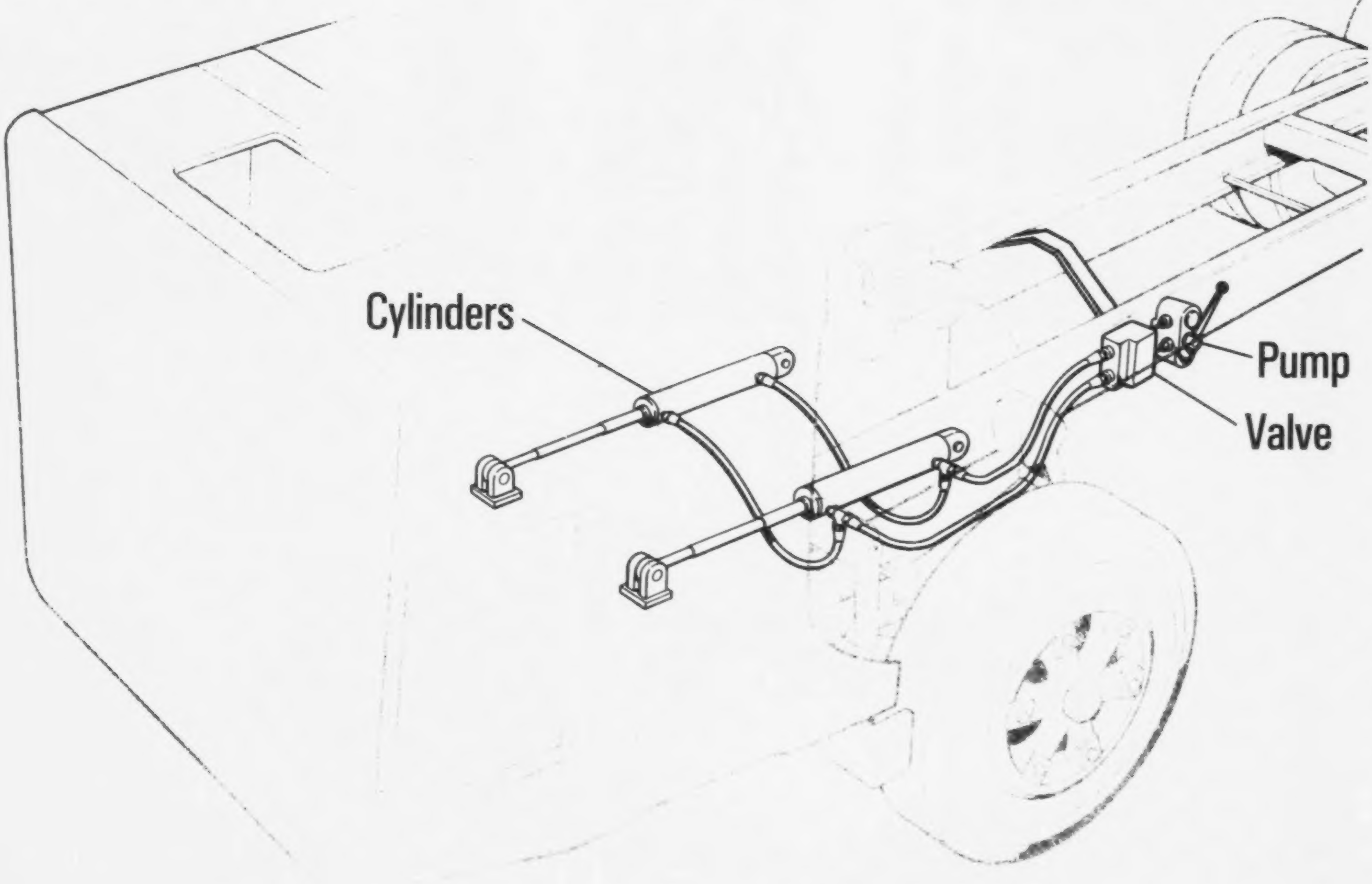
Secondary Controls

- Secondary Controls Vary With Vehicle Models
- You Need to Refer to Operator's Manual
- Most Controls You Need to Learn to Operate Are:

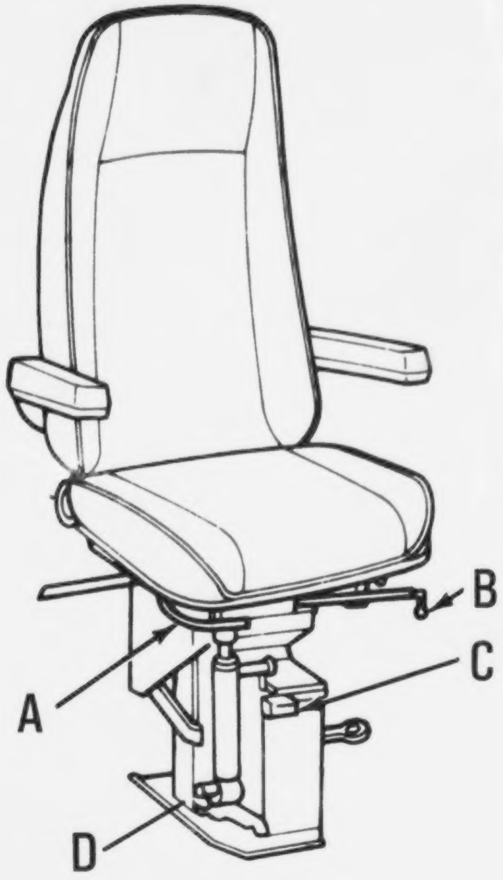
Controls Used For	*Examples of Controls*
Seeing and Being Seen	Light Switches, Windshield Wipers, Washers
Communications	Turn Signals, Horns, CB Radio
Climate Control	Air Conditioner, Heater, Defroster
Comfort	Tilting, Steering Wheel, Seat Position Controls
Safety	Seat Belts!

Visual 13

Hydraulic Tilt Cab Operation


Cylinders
Pump
Valve

Example: Air Suspension Seat Controls



A. Automatic Squeeze-Lever Adjustment. Air Control Lever Instantly Adjusts to Driver's Weight. Rotation of Lever Provides Correct Height Adjustment.

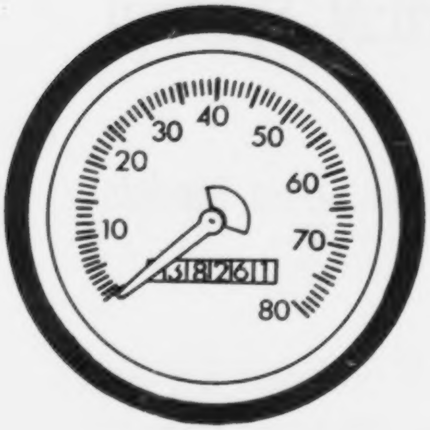
B. Fore-and-Aft Seat Position Adjustment. Upper Seat Assembly Moves 4" Forward and Backward.

C. Three-Position Seat Cushion Tilt Which Adjusts a Full 6°.

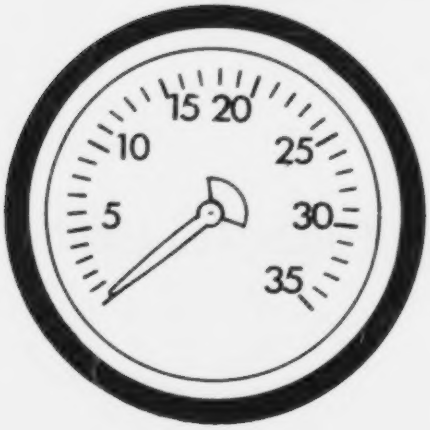
D. Shock Release Lever Disengages In-and-Out Shock Adsorber for Normal Ride.

Visual 15

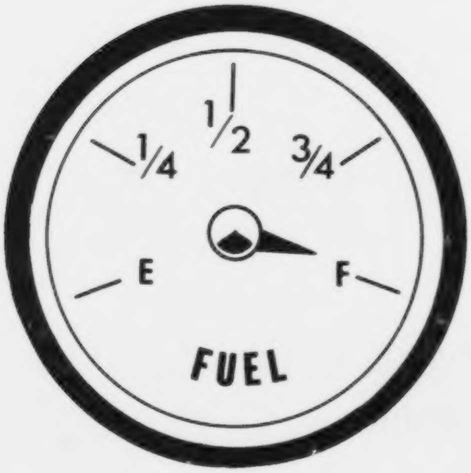
Basic Instruments


10
20
30
40
50
60
70
80

- Measures Speed in MPH
- Caution–Not Always Accurate


5
10
15
20
25
30
35

- Measures Engine Speed in RPMs
- Tells You When to Shift

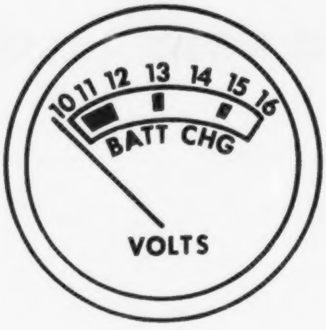

E
1/4
1/2
3/4
F
FUEL

- These Aren't Always Accurate Either, Inspect the Fuel Tank!
- May Have Separate Ones for Each Tank

Visual 16

Measuring the Electrical System

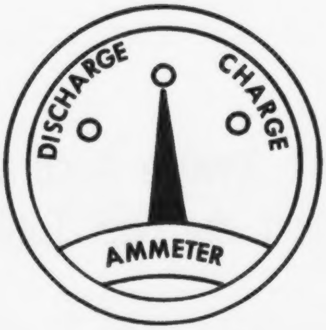
Voltmeter (In Some Models)


10
11
12
13
14
15
16
BATT CHG
VOLTS

Starting
  Green–Well Charged Battery
  Yellow–Low Battery Charge
  Red–Very Low Charge

Operating
  Green–Okay
  Red–Voltage Output Too High!

Ammeter

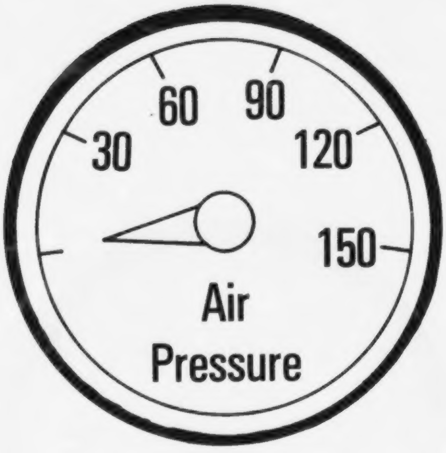

DISCHARGE
O
O
O
CHARGE
AMMETER

Normal Is "Zero"

Continuous High Charge + or Discharge –

Means Problems in the Electrical System

Basic Pressure Gauges


30
60
90
120
150
Air
Pressure

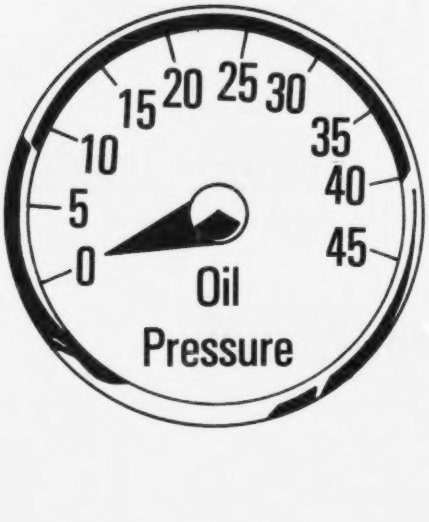
Air Pressure

Normal 95-120

Low 60 STOP!

Low 45-BRAKES COME ON!

Oil Pressure


0
5
10
15
20
25
30
35
40
45
Oil
Pressure

Idling 5-20 PSI

Operating 35-75 PSI

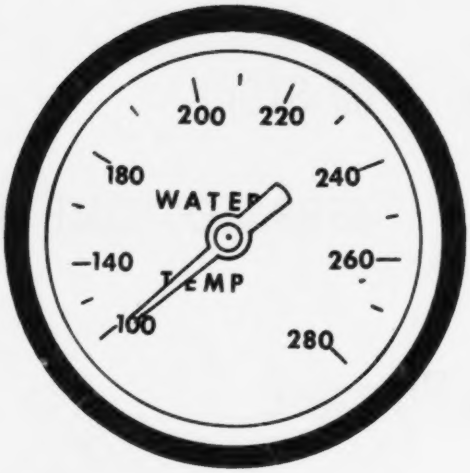
Low, Dropping, Flucuating

STOP! IMMEDIATELY!

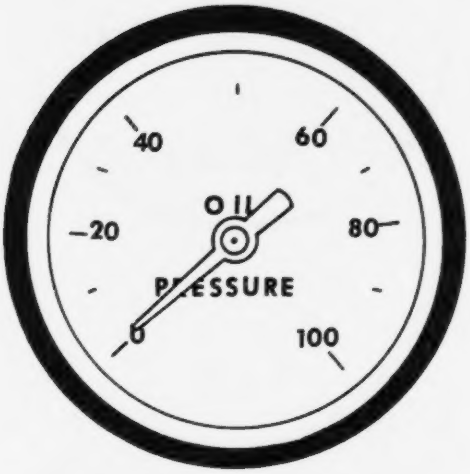
Without Oil the Engine Can Be Destroyed Rapidly

Visual 18

Basic Temperature Gauges


200
220
180
240
WATER
TEMP
140
260
100
280

Collant Temperature
Normal 170-195


40
60
-20
80
OIL
PRESSURE
0
100

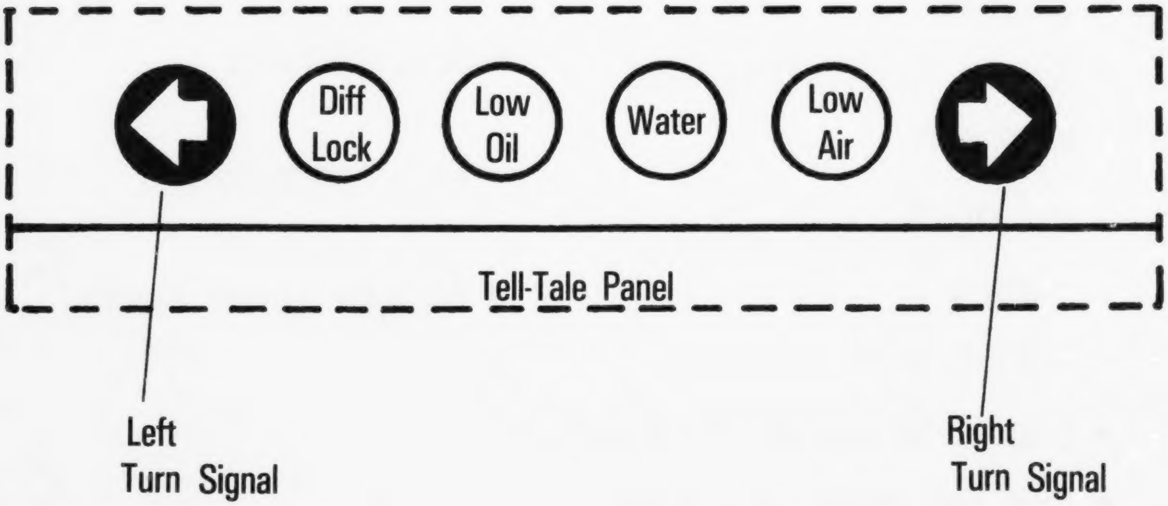
Oil Temperature
180-225
250-265 Loaded

(Depending on Engine Model)

Visual 19

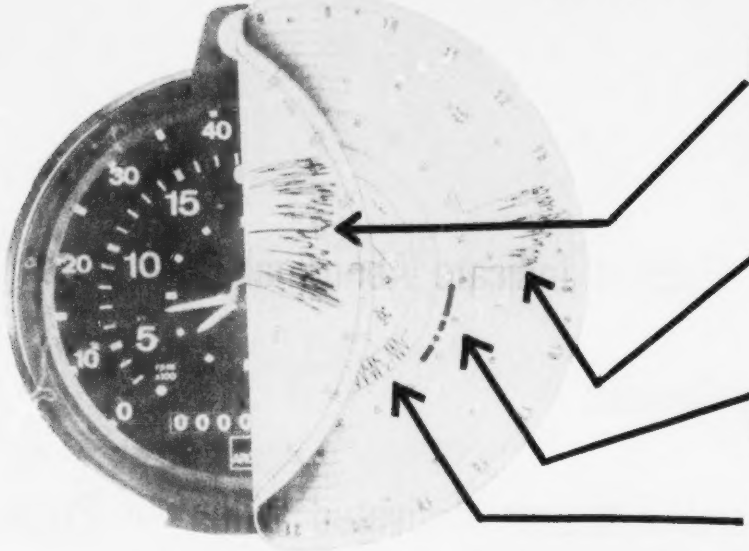
Warning Devices

- Types of Devices
  - –Flashing Lights, Buzzers Indicate Abnormal Conditions
- Low Air Warning Devices
  - –Flashing Light and/or Buzzer (Activated When Air Pressure Drops to Approximately 60 PSI)
- Tell Tale Panel


Diff Lock
Low Oil
Water
Low Air
Tell-Tale Panel
Left Turn Signal
Right Turn Signal

Visual 20

Tachograph



Engine Speed in RPM

Road Speed in MPH

Driving and Stopping Periods

Miles Traveled

Information Recorded:

- Shows Each Mile Traveled
- Shows Actual Time That Engine Is
  - –Running
  - –Idling
  - –Shut Off
- Shows Speed at Any Time
- Can Tell What Gear You Were In!

Information Used For:

- Legal Protection
- Analyze Runs
- Fuel Economy Aid
- Monitor Driver Habits!

LESSON 2 INSTRUMENT AND CONTROL FAMILIARIZATION (LAB)

Overview

Time Allotted: 45 minutes

Prerequisites: Lesson 1 of Unit 1.2

Purpose:

The purpose of this lesson is to point out and briefly explain the instruments and controls in a truck-tractor cab and to demonstrate the use of secondary controls and instruments.

Materials

Instructional Aids

None

Student Material

None

Instructor Material

Instructor Aid #1 - Vehicle Controls (at end of this lesson)
Instructor Aid #2 - Vehicle Instruments (at end of this lesson)
Pointer to indicate controls and instruments

Equipment

A 5-axle tractor-trailer for demonstration purposes.

Facilities

This lesson should take place on the range, in the shop, or another building depending on weather conditions.

Content

Activity or Topic	Approximate Time
1. INSTRUCTOR DEMONSTRATION: VEHICLE CONTROLS AND INSTRUMENTS	45 minutes

1. INSTRUCTOR DEMONSTRATION: VEHICLE INSTRUMENTS AND CONTROLS (45 minutes)

Purpose

The purpose of this exercise to introduce the students to the basic controls and instruments in a tractor. It is a demonstration with questions and answers and no student evaluation.

Layout

A coupled tractor and trailer. Instructor should conduct most of demonstration from the driver's seat of the tractor.

Exercise Direction

Preparation

Use three students to one instructor/vehicle ratio. Schedule each group to go through the lesson with a qualified instructor.

Instructor Demonstration: Vehicle Controls and Instruments (30 minutes)

Use Instructor Aids 1 and 2 as guides to systematically identify all vehicle controls and instruments. (For those instruments or controls that are not present on the demonstration vehicle merely point out the propable location if it were present.)

Operate a control and describe what you are doing, where it is feasible.

Vehicle Controls

--Describe or demonstrate operation of all vehicle controls, e.g., operate light switches, seat position controls, demonstrate depression of brake and clutch pedals, operation of spring brakes, etc.

--Do not get into detailed demonstration of any of the primary controls that will be demonstrated and practiced in Units 1.4, Basic Control and 1.5, Shifting.

--Keep in mind the major purpose of this lesson is only basic familiarization with controls and instruments.

Vehicle Instruments

--Locate and identify all vehicle instruments.

--State the proper and improper readings under basic vehicle conditions: engine start up, idling, warmed up engine, operating under heavy load.

Point out any panel instructions that apply to instrument, e.g., improper ranges for instruments on the instrument panel.

Start the engine to demonstrate operation of low air and other warning devices and instrument readings as engine starts and warms.

Student Question and Answer Period (15 minutes)

Answer questions about the function and operation of vehicle controls and instruments.

Defer detailed question to their appropriate unit in the course, e.g., questions about shifting to Unit 1.5, etc.

INSTRUCTOR AID #1: VEHICLE CONTROLS

Describe or demonstrate operation of all vehicle primary and secondary controls

Engine starting and shutdown controls

- o Engine control (on/off) switch
- o Hand throttle*
- o Starter button*
- o Auxiliary starter button*
- o Engine stop control knob
- o Compression release valve*
- o Emergency engine stop control

Primary controls

- o Steering wheel (including tilt operation)
- o Accelerator pedal
- o Clutch pedal*
- o Transmission controls
  - -- gearshift levers
    - - automatics and semi-automatics
    - - manual gear shift levers, including dual sticks, single stick with range selectors and/or splitter switch
  - -- Rear axle speed control
- o Brake controls
  - -- Foot brake
  - -- Trailer brake
  - -- Spring brake control*
  - -- Tractor protection valve

Other primary controls

- o Front brake limiting valve*
- o Engine brake controls*
- o Interaxle differential lock control*

Secondary controls

- o Systems not related to movement of vehicle--e.g., cab tilt controls, 5th wheel air slider control*
- o Seeing--e.g., light switchs, windshield wiper controls
- o Communications--e.g., horns, radios, turn signals and hazard signals
- o Climate controls--e.g., heater, defroster, air conditioning controls
- o Comfort controls--e.g., seat position controls
- o Driver safety--e.g., seat and lap belts

---

*If so equipped.

INSTRUCTOR AID #2: VEHICLE INSTRUMENTS

Identify vehicle instruments and describe proper/improper readings under basic operating situations, e.g., starting, idling, warmed up, operating with a heavy load.

Basic instruments
- o Speedometer
- o Odometer
- o Fuel gauge
- o Tachometer
- o Ammeter/voltmeter

Pressure gauges
- o Air Reservoir
- o Oil
- o Air application gauge*
- o Clutch fluid pressure*
- o Tire pressure*
- o Turbo pressure*

Temperature gauges
- o Coolant
- o Oil*
- o Exhaust pyrometer*
- o Gear box temperature*
- o Axle temperature*

Warning devices
- o Telltale panel lights, warning or buzzers

Tachograph*

---

*If so equipped.

Notes:

UNIT 1.3
VEHICLE INSPECTIONS

UNIT 1.3 VEHICLE INSPECTIONS

PURPOSE

The purpose of this unit is to stress the importance of systematic vehicle inspections and to help develop the skills necessary for good inspection. Students will learn pretrip inspection procedures used throughout this course.

OBJECTIVES

Performance Objectives

Students must be able to

- inspect and make a determination of the condition of various critical vehicle components, including instruments and controls; engine and drive train; chassis and suspension; steering system; braking system; tires, wheels, and rims; lighting and signaling system; emergency equipment; and cargo securement device(s).
- perform pretrip inspections in a regular, systematic sequence that is accurate, uniform and time efficient.
- perform enroute inspections by checking mirrors for signs of trouble; monitoring instruments and looking, listening and feeling for indications of malfunctions; making periodic roadside stop inspections of critical items; and meeting enroute requirements for transporting hazardous materials type cargo.
- perform post-trip inspections by making accurate notes of actual and suspected component abnormalities or malfunctions that occurred during the trip.

Students must not operate a vehicle found to be in unsafe (for vehicle, driver, and other road users) operating condition, either prior to a trip or enroute.

Knowledge Objectives

Student must know

- a systematic procedure to assure a rapid and complete inspection.
- the effect of undiscovered malfunctions upon safety, effectiveness, and economy.
- the importance of having malfunctions corrected quickly.

- Federal, State, and other regulations governing inspection, including special regulations for hazardous cargo.
- Procedures for post-trip inspection.

Skill Objectives

None

Attitude Objectives

The student must believe

- that the consequences of breakdowns and accidents justify time spent on inspections.
- it is the driver's obligation to the employer and other road users to ensure that the vehicle is in safe operating condition before taking it out on the road and to cease operating it if an unsafe condition has been discovered.

LESSONS

Lesson 1.	**Vehicle Inspections:**	**Procedures (Classroom)**	**2 hours**
Lesson 2.	**Vehicle Inspections:**	**Practice (Lab)**	**4 hours**

LESSON 1 VEHICLE INSPECTION: PROCEDURES (CLASSROOM)

Overview

Time Allotted: 2 hours

Allow additional time if procedures for other type vehicles such as doubles, tankers and refrigerator vehicles are discussed.

Prerequisites: Units 1.1 and 1.2

Purpose:

The purpose of this lesson is to introduce students to the reasons for conducting pretrip, enroute and post-trip inspections and to present to them a systematic procedure for doing so. In addition to the presentation of information, there is a short reviw quiz and discussion ending the lesson.

Materials

Instructional Aids

Visuals 1-20

Student Material

Copy of the Federal Motor Carrier Safety Regulations that apply to this unit
Walkaround sequence of illustration, in Unit 1.3 of Student Manual
Review Quiz, in Unit 1.3 of Student Manual

Instructor Material

Copy of the Federal Motor Carrier Safety Regulations Sections 392.7, 392.8, 393.9, 393.95, 393.100, 303.104, 303.106, 396.7, 396.9, 396.11, 396.13 and 397.17. There are excellent industry trade journal articles, accident reports and films which may be used to aid the instructor in impressing the students with the critical need for always performing thorough pretrip inspections.

Content

Activity or Topic	Approximate Time
1. TYPES OF VEHICLE INSPECTIONS AND THEIR IMPORTANCE	10 minutes
2. WHAT TO LOOK FOR WHEN INSPECTING VEHICLES	20 minutes
3. PRETRIP INSPECTION PROCEDURES	45 minutes
4. ENROUTE AND POST-TRIP INSPECTIONS	5 minutes
5. ADDITIONAL PROCEDURES FOR SPECIAL VEHICLES	15 minutes
6. REPORTING YOUR FINDINGS	5 minutes
7. SUMMARY AND REVIEW	20 minutes
	2 hours

1. TYPES OF VEHICLE INSPECTIONS AND THEIR IMPORTANCE (10 minutes)

Visual 1 Goal of Inspection

Goal of Inspection

To Identify

A system or part that is malfunctioning, has already failed, or is missing
A system or part that is in imminent danger of failing or malfunctioning
A system or part that is functioning properly
The legal requirements for various parts or system conditions

Vehicle Inspection Responsibility

Driver is Responsible For

Safety of vehicle
Safe delivery of cargo

Vehicle Inspection Part of Job

Provide for detection of most potential malfunctions
Does not require a trained mechanic

Three Types of Inspection

Pretrip Inspection

A systematic vehicle component check always conducted prior to each trip to detect defects that could cause accidents or breakdown or inferior performance
Required by law for interstate commerce, usually required by company policy and always required for "common sense safety"

Enroute Inspection

Monitoring instruments and mirrors while driving

Uses senses to check for problems
- Look
- Listen
- Smell
- Feel (brakes dragging, flat tires, etc.)

Conducts critical item check at each stop with particular attention to these items:
- Tires, wheels and rims
- Brakes
- Lights
- Air and electrical connections to trailer

        - Trailer coupling devices
        - Cargo securement devices
            - Required for safety and economy
            - Frequently required by law

Post-Trip Inspection

- Critical item check at end of trip, day or tour of duty on each vehicle operated
    - Includes filling out vehicle condition report listing any defects discovered by you during operation of the vehicle
- Vehicle condition report frequently required by law, usually by company policy

NOTE: In describing the consequences of inadequate inspection, provide examples--preferably from cases drawn from your own experience.

Four Basic Reasons for Inspection

Safety--The most important and obvious reason

- Helps avoid the mechanical defects and malfunctions that increases the likelihood of an accident

Economy--Poorly done or skipped inspections can cost money

- Maintenance--Small problems can quickly become big repairs

- Vehicle life--Unattended problems shorten vehicle life

- Poor mileage--Fuel costs resulting from low miles per gallon

- Breakdown costs or "out-of-service"
    - Towing costs
    - Travel and overtime for company mechanics
    - Higher repair costs from unfamiliar garages
    - Costs due to delay in delivery of cargo

Public Relations--Trucking industry needs good will of public

- Bad publicity from
    - Accidents
    - Breakdowns that cause traffic delays
    - Smoking or loud exhaust
    - Poor condition (appearance) of vehicle

Legality

- Federal and State laws require certain inspection activities

- Commercial vehicle inspection is conducted by Federal and State inspectors

- Equipment not meeting requirements can be put "out of service" until repairs are made

Three Elements of a Good Inspection

Knowing what to look for.

Having a consistent way of looking for it.

Being able to report findings in a technically accurate way so that mechanic will be able to identify and repair problem.

2. WHAT TO LOOK FOR WHEN INSPECTING VEHICLES (20 minutes)

Introduction

Driver Needs the Knowledge to Recognize

A system or part that is malfunctioning
A system or part that is in imminent danger of failing or malfunctioning
A system or part that is functioning properly
The difference betwen major and minor defects and those defects that are illegal and will subject a vehicle to being placed "out of service" by federal/state inspectors

This Section Discusses a Variety of Defects

Visual 2 Example of Safety Defect: Fluid Leaks

Fluid Leaks

- Consequences
  - Many engine breakdowns and serious engine damage occurs because o a loss of coolant or lubricant
- Fires can result from fuel leaks

- Driver should check:
  - Fluid levels
    - Oil
    - Coolant
    - Battery
  - Signs of fluid loss under vehicle
    - Oil
    - Coolant
    - Fuel
- Driver should check gauges frequently while driving

Visual 3 Example of Safety Defect: Interference with Visibility

Interference with Visibility

Driver should:

- Check hose connections and loose wires
- Check for missing or broken lights
- Test horns
- Test signal lights
- Clean cab windows inside and out
- Check windshield wipers
- Clean lights and reflectors
- Clean and adjust rearview mirrors

Visual 4 Example of Safety Defect: Damaged Tires

Bad Tires

Tire defects increase the chances of a blowout and make handling difficult

Federal regulations forbid operation with bad tires

Driver should check for tires that are

- Underinflated
- Badly worn
- Cut or otherwise damaged
- Mismatched (radials and bias-ply)
- Kissing, i.e., dual tires that come in contact with each other or parts of the vehicle
- Mismatched type or size
- Cut or cracked valve stems

Visual 5 Example of Safety Defects: Missing Wheel Lugs

Wheels and Rims

Defective wheels or rims could cause a wheel to come off and be the cause of a serious accident

Driver should check for

- Damaged rim can cause tire to lose pressure or come off the rim on a turn
- Rust trails indicate rim is loose on wheel--check snugness of lugs
- After a tire has been changed, stop a short while thereafter and recheck snugness of lugs--they will probably need retightening
- Missing clamps, spacers, studs, lugs are dangerous
- Mismatched, bent, cracked, lock rings spell trouble
- Unevenly tightened lugs on some wheels will cause wheel wobble--cause premature tire failure and excessive vibration
- Wheels or rims that have had welding repairs are not safe

Visual 6 Example of Safety Defects: Chafed and Worn Air Hose

Braking System Defects

Braking system defects are extremely dangerous.

The inability to stop efficiently can be fatal.

Driver should check

- Air pressure
    - Pressure loss -- no audible leaks permissable
        - No more than 3 lbs/minute with engine running and no brakes applied
        - No more than 4 lbs/minute with engine off and brakes fully applied (after initial application)
    - Missing or defective gauges
    - Defective low air warning devices
- Brake chambers, drums and shoes
    - Cracked drums, worn or missing brake shoes
    - Contaminated by oil, grease, brake fluid
    - Broken or missing shoes
    - Shoes won't contact surface
    - Damaged or missing brake chambers, slack adjusters
- Brake lines
    - Audible leaks
    - Air lines that are
        - Not secured properly
        - Hardened or swollen
        - Chafed or worn down into any fabric or steel braid
        - Cut or cracked
        - Crimped or pinched or otherwise restricted
        - Improperly spliced or taped
- Air reservoir
    - Not properly attached to vehicle
    - Contain excessive water
    - Lack check valves
- Brake lines to trailer (emergency and service lines)
    - Air leaks
    - Brake lines that are
        - Improperly attached or supported
        - Tangled
        - Restricted
        - Damaged

Brake adjustment

All brakes to be in proper adjustment (will be taught in Section 4)

Visual 7 Example of Safety Defects: Excessive Steering Wheel Play

Steering System Defects

Any defects in steering system are hazardous as they may affect the ability of the driver to control the vehicle.

Problem accentuated by
- Speed
- Heavy front end loads

Driver should look for
- Any missing nuts, bolts, cotter keys or other parts
- Bent, loose, or broken parts, such as steering column, steering gear box, or tie rods
- If power steering equipped--hoses, pumps, and fluid level and/or leaks, or compressed air leaks
- Steering wheel play of more than 10° is dangerous and makes vehicle difficult to control
- Steering wheel play of 30° or more is illegal

Steering play of 30° puts vehicle "out of service" but play of 10° or more is dangerous and needs attention

Visual 8 Example of Safety Defect: Broken Leaves in Leaf Spring

Suspension Systems Defects

Since the suspension supports the vehicle and its load and maintains the axle alignment and attachment, serious failure could have tragic results.

Driver should check for
- Cracked, broken torque arms, U-bolts
- Hangers that allow displacement of axle from proper position
- Missing or broken leaves in any leaf spring (1/4 or more missing will put the vehicle "out of service") but any defect is dangerous
- Leaking or failed shock absorbers
- Cracked or broken spring hangers
- Any torque arm, U-bolts, spring hangers or other axle positioning parts that are missing or damaged
- Air suspension systems that are damaged and/or leaking
- Broken leaves in a multi-leaf spring or leaves that have shifted so as to contact tires, wheels, frame or body
- Missing or broken torque rods
- Any loose, cracked, broken or missing frame members

Visual 9 Example of Safety Defect: Exhaust System in Contact with the Fuel System

Exhaust System Defects

Faulty exhaust system can lead to fumes in cab or sleeper berth.

Driver should check for
- Loose, broken, or missing exhaust pipes, mufflers, tailpipes or vertical stacks
- Loose, broken, or about to fail mounting brackets, clamps, bolts or nut
- Exhaust system parts rubbing against fuel system parts, tires or other moving parts of vehicle
- Exhaust system parts that are leaking in an area where the air stream will carry fumes into cab or sleeper

Visual 10 Example of Safety Defect: Crack in Fifth Wheel

Coupling System Defects

Failure of the coupling system (upper or lower fifth wheel) can cause serious accidents and/or cargo damage.

Driver should check for
- Excess slack in the fifth wheel locking mechanism
- Cracks or breaks in any part of the fifth wheel assembly
- Bent, broken, or missing parts of the locking mechanism
- Missing pins or other defects in the slide mechanism of sliding fifth wheels
- Bent, cracked, or excessively worn kingpins
- Missing u-bolts, cracked or broken welds or other defects in fifth wheel mounting device(s)

Cargo Problems

Must be checked to make sure it is secured against movement.
Unsecured cargo a frequent accident cause.
Will be taught in Unit 5.1 Cargo Handling.

FMCSR Part 396, Inspection, Repair and Maintenance of Motor Vehicles Regulations

Drivers must by law know requirements FMCSR 396.9, Motor Vehicles Declared Out of Service.

Prohibits a driver from operating a vehicle that is "imminently hazardous to operate."

Prohibits a motor carrier from requiring or permitting a driver to operate such a vehicle.

A vehicle that is "imminently hazardous to operate" can be put out of service by Federal or State inspectors during roadside inspections.

Visual 11 Examples of "Out-of-Service" Defects

Safety defects considered "imminently hazardous" include:

- Defective steering system
- Missing/inoperative brake shoes
- Cracked brake drums
- Serious air loss in brake system
- Missing/inoperative lights
- Bald or defective tires
- Cracked wheels/missing lug nuts
- Fuel system leaks
- Defective coupling system
- Cargo that can shift or fall out onto road

3. PRETRIP INSPECTION PROCEDURES (45 minutes)

Professional Drivers and Vehicle Inspections

Drivers have a moral and legal obligation to employer, other motorists and to self to always conduct a thorough pretrip inspection of any vehicle assigned to drive.

It takes much longer to learn how to do a quality pretrip vehicle inspection than it actually takes to do one -- after hours of practice you will end up knowing how to do one in less than 15 minutes.

The secret to making rapid and accurate pretrip inspections, is to learn a method or systematic step by step procedure - that way no matter whether the dispatcher is pressuring you to "get going," its a dark night or the weather is bad, you won't accidently forget to check some key part of your vehicle.

In this class you will be taught a method called the **"SEVEN-STEP PRETRIP INSPECTION PROCEDURE."**

The seven step method will become a regular part of your routine throughout the rest of this course - learn it and practice it over and over at every opportunity so that it becomes second nature to you - it could save your life some day.

Your ability to learn and use the seven-step method for pretrip inspections will be a requirement for graduation from this course.

Why so much emphasis on pretrip inspections?

- o Surveys show that many of todays drivers have never been taught and thus do not know how to perform adequate pretrip inspections.
- o A professional driver's duty is to drive safely -- you can't do this with a defective vehicle.

- A vehicle system or part that is defective can be responsible for increased operating cost -- example: a leaking fuel line not only is a fire hazard it wastes precious fuel.
- Driver's self interest -- doing a good pretrip is not only a sign of professionalism -- it can save you a long walk through a snowstorm or in desert heat to find a telephone to report a breakdown -- or prevent injury or death in the case of an accident caused by a vehicle defect.
- Safety of other motorists -- road failures or breakdowns often result in the vehicle being stalled in a hazardous location and may cause another person to wreck and/or run off the road, trying to avoid striking the stalled vehicle.

Visual 12 Key Characteristics Of Good Inspection

Characteristics of a Good Pretrip Inspection

Consistent

Inspection is always performed in the same sequence each and every time

Developing and practicing a consistent sequence is the only way to perform quality inspections in a minimum amount of time

Efficient

An efficient inspection sequence reduces the amount of time required for inspection by eliminating wasted motion

Thorough

Not possible to conduct an inspection as thoroughly as a trained mechanic

It is the things that drivers can and should be able to spot that are most likely to cause breakdowns and/or accidents.

A checklist of critical items should be thorough enough to ensure the safety and legality of the vehicle

Visual 13 Federal Vehicle Condition Requirements

Federal Requirements -- as stated in the Federal Motor Carrier Safety Regulations (FMCSR)

Vehicle Condition

NOTE: Refer to students appropriate section of FMCSR.

FMCSR 392.7 requires: "No motor vehicle shall be driven unless the driver thereof shall have satisfied himself/herself that the following parts and accessories are in good working order..."

- Service brakes, including
    - Trailer brake connections
    - Parking (hand) brakes
- Steering mechanisms
- Lighting devices and reflectors
- Tires
- Horn
- Windshield wiper or wipers
- Rear vision mirror or mirrors
- Coupling devices

FMCSR 396.7

- A motor vehicle shall not be operated in such a condition that it is likely to have a breakdown or an accident

FMCSR 396.11

- Driver required to prepare report in writing at the completion of each days work on each vehicle operated
- Report will identify defects or deficiencies that would affect safety or operation of motor vehicle or result in its mechanical breakdown
- If vehicle has no defects -- a report is still required and must show "No Defects"

FMCSR 396.13

- Driver must be satisfied that the vehicle is in safe operating condition
- Must review and sign the previous vehicle condition report to certify that he/she has reviewed it and that required repairs have been made

Emergency Equipment

FMCSR 392.8 requires that a vehicle be equipped with proper emergency equipment

- Fire extinguishers
- Spare fuses (unless equipped with circuit breakers)
- Emergency warning devices (FMCSR requires reflective warning triangles)

NOTE: Specifications in FMCSR 393.95.

Cargo

Driver responsible for inspecting cargo for securement (FMCSR 392.9) before trip

NOTE: Specifications for securement in 393.100-106.

If cargo contains hazardous materials, a driver must inspect for

- Proper documentation (397.19)
- Placarding (397.21)

NOTE: More detailed discussions of cargo securement and documentation occur in Units 5.1 and 5.2.

Visual 14 Seven-Step Pretrip Inspection Checklist

Inspection Procedures

Many methods for pretrip inspection
Must learn and practice methods required by employer
Seven-step method of inspection will be taught and practiced here and will be briefly described next, followed by a detailed discussion of each step

NOTE: Students should refer to copy of pretrip inspection checklist in their Student Manual, Unit 1.3, for remainder of this lesson.

Step 1 Approach Vehicle--Approaching vehicle, look at overall condition, damage or fluid leakage.

Step 2 Check Under Hood or Cab--Raise cab or hood and complete engine compartment inspections.

Step 3 Start Engine and Check Inside Cab--Enter cab, start engine warmup and commence primary and secondary controls and instrument check. Check condition of all emergency equipment (fire extinguisher, etc.).

Step 4 Check Lights--Shut down engine, secure parking brake (chock wheels if necessary), leave cab and check high/low beam headlights and four-way emergency warning flashers.

Step 5 Conduct Walkaround Inspection--Extinguish headlights and four-way flashers, turn on parking clearance and identification lights, put right turn signal on and commence the walk around inspection.

Step 6 Check Signal Lights--Extinguish all lights, turn on left turn signal and activate stop lights.

Step 7 Check Air Brake System--Enter cab, extinguish all lights, conduct standing and rolling air brake system tests and a final instrument check.

Step 1. Approach the Vehicle

Note general condition, i.e., damage, vehicle leaning to one side, etc.
Glance under tractor for signs of fresh oil, coolant, grease or fuel leaks; fresh leaks indicate sure trouble.

Step 2. Check Under the Hood (or Cab)

First check that brakes are applied and/or wheels chocked
Raise the hood or tilt cab (make sure no loose articles in cab)
Check the following:
- Oil level in crankcase
- Coolant level in radiator

Power steering fluid level and hoses*
Windshield washer fluid level
Battery fluid level, connections and tie downs
Automatic transmission fluid level*
Engine oil make-up reservoir*
All belts for tension and signs of excessive wear (generator, water pump, air compressor)--push belts with hand, and if they deflect more than 1/2 to 3/4 of an inch, slippage is probably excessive
Leaks in the engine compartment including fuel, coolant, oil, power steering fluid, hydraulic fluid, battery fluid
Cracked, worn wiring and insulation

Lower and secure hood or cab
Check both "wet" and "dry" air reservoirs (tanks) by opening the petcocks (see "Post-trip Inspection Procedures) and then close petcocks again
Double check all primary and secondary latches

Step 3. Start Engine and Inspect Inside the Cab

Enter the Cab and Start the Engine

Make sure parking brake is on
Depress clutch, place gearshift lever in neutral
Press starter, release when engine starts
    Listen for unusual engine sounds or noises

Monitor the instruments (with engine at idle--800 to 1,000 rpms)

Oil pressure--should register within seconds after engine is started and begin gradual rise to normal operating range

Ammeter/Voltmeter--needle will jump and flutter, then will register "charge"

Coolant temperature--will begin gradual rise to normal operating range

Engine oil temperature--will begin gradual rise to normal operating range

Air pressure--let it build to governed cut-out pressure, should occur between 100-125 psi

Warning lights and buzzers--(1) oil, coolant, generator warning lights should go out almost immediately and (2) low air pressure warning should cease at approximately 60 psi

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* When vehicle is so equipped

Check Conditions of Controls

Check all of the following for signs of excessive looseness, sticking, binding, inadequate spring return, exterior damage, or, improper setting

Primary controls

- Steering wheel
- Clutch
- Accelerator
- Brake controls
  - Foot brake (treadle valve)
  - Trailer brake
  - Parking brake
  - Front brake limiting valve
  - Tractor protection valve
  - Engine exhaust brake
- Transmission controls
- Interaxle differential lock

Secondary controls

- Horns
- Windshield wiper/washer
- Lights
  - Headlights
  - Dimmer switch
  - Body blinker light switch
  - Turn signal
  - Emergency 4-way flashers
- Climate control
  - Heater
  - Defroster
  - Air conditioning
- Other
  - Power take off (controls)
  - Remote control for air operated fifth wheel

Check Controls for Operation

Primary controls

Nonpower steering--work the steering wheel back and forth. Should have less than 5°-10° free play

Power steering Need to be in position to see front left wheel
- Work steering wheel from left to right (with engine running) and note degree of free play that occurs before front left wheel barely moves--should be less than 5°-10°
- Listen for unusual noises from pump

Accelerator and brake pedals--for looseness or binding

Clutch pedal--for proper amount of free play

Secondary Controls--test operation of horn, windshield wipers, climate controls, interior lights, (instrument and dome lights)

Check for Vision

Inspect mirrors and windshields for cracks, dirt, illegal stickers or obstructions to view
Clean and adjust as necessary

Check Emergency Equipment

- Check for DOT required safety equipment
- Fusees (flares)
- Spare electrical fuses
- Three red reflective triangles
- Properly charged and rated fire extinguisher
  - Optional items such as
    - Snow chains (in season)
    - Tire changing equipment
    - Spare lamps, bulbs, electrical tape and tools (flashlight, pliers, screwdriver, wire, tire pressure guage)
  - List of emergency phone numbers
  - Accident reporting kit (packet)

Turn Off the Engine and Leave the Cab

When air pressure has built to governor cut-out pressure, turn off engine, place transmission in lowest forward gear, set parking brake, turn on headlights (low beams) and four way flashers, then leave cab

SAFETY NOTE: Always remove starter switch key and place in your pocket -- otherwise someone might move rig while you are checking underneath it.

Step 4. Check Lights

Go to front of vehicle and check low beams for operation and visually inspect alignment, check that both of the four-way flashers are operating
Reach in cab and push dimmer switch and then check high beam headlight operation/alignment
Inspect, clean, and adjust mirrors

Step 5. Conduct Walkaround Inspection

Return to cab
Turn off headlights and four-way hazard warning flashers
Turn on parking, clearance and indentification lights.
Activate right turn signal, leave cab and start walkaround inspection

Visual 15 Walkaround Sequence of Step 5 of Pretrip Inspection

NOTE: Describe Step 5, walkaround inspection sequence, using Visual 15 which illustrates the sequence and identifies key stops. Point out what items you will be inspecting and what you will be looking for at each key stop. The outline below will aid you.

General

- Walkaround and inspect in sequence outlined
- Inspect for general condition and damage, including fluid or air leaks
- Check for dirty, missing or broken lights, reflectors
- Clean all lights, reflectors and glass with clean rag as you go along
- Check key items for specific defects, e.g., tires, wheels, coupling devices, landing gear

Left Side of Cab Area

- Note general condition
- Driver's door glass and door latches, lock
- Left front wheel
  - Condition of wheel and rim--missing, bent, broken studs, clamps, lugs, any signs of misalignment
  - Condition of tires--properly inflated, valve stem and cap OK, no serious cuts, bulges, tread wear
  - Must use wrench to test for looseness on suspicious looking or rust streaked lug nuts, indicating looseness
  - Wheel bearing, or hub oil seal and level--OK
- Left front suspension
  - Condition of spring, spring hangers, shackles, u-bolts
  - Shock absorber condition
- Left front brake (if so equipped)
  - Condition of brake drum
  - Condition of hoses
  - Check slack adjustors

Front of Cab Area

- Condition of front axle
- Condition of steering system
  - No loose, worn, bent, damaged or missing parts
  - Must grab steering mechanism to test for looseness
- License plate(s), present, secured and any other legally required inspection stickers, tax plates, decals, etc.
- Condition of windshield
  - Check for damage and clean if dirty
  - Check windshield wiper arms for proper spring tension
  - Check wiper blades for any damage, "dead" rubber and securement to arm
- Lights and reflectors
  - Cab parking, clearance and identification lights, clean, operating and proper color
  - Reflectors clean and proper color
  - Right front turn signal light clean, operating, and proper color

Right Side of Cab Area

- Check all items as done on left side of cab area
- If a COE tractor-check cab tilt mechanism
  - Check proper operation
  - Primary and safety locks engaged

Right Saddle Tank Area

- Right fuel tank(s)
  - Securely mounted, not damaged or leaking
  - Fuel crossover line secure
  - Tank(s) full of fuel
  - Cap(s) on and secure
- Condition of visible parts
  - Rear of engine--not leaking
  - Transmission--not leaking
  - Drive shaft--looks OK
  - Exhaust system--secure, not leaking, not touching wires, fuel or airlines
  - Frame and cross members--bends, cracks
  - Air lines and electrical wiring--secured against snagging, chafing
  - Spare tire carrier or rack not damaged (if so equipped) strong enough to carry load
  - Tire and/or wheel securely mounted in rack
  - Tire and wheel condition adequate for a spare, proper size, properly inflated

Coupling System Area

- Fifth wheel (lower)
  - Securely mounted to frame
  - No missing, damaged parts
  - Properly lubricated
  - No visible space between upper and lower fifth wheel
  - Locking jaws around the shank and not the head of kingpin
  - Release arm properly seated and safety latch/lock engaged
- Fifth wheel (upper)
  - Glide plate securely mounted to trailer frame
  - Kingpin not worn, bent or damaged
- Air and electric lines to trailer
  - Electrical line firmly seated and secured against tangling snagging and chafing
  - Air lines properly connected to glad hands, no air leaks, properly secured against tangling, snagging and chafing, sufficient slack for turns
  - All lines free from damage, oil and grease
- Sliding fifth wheel
  - Mechanism not worn, bent, damaged or parts missing
  - Properly lubricated
  - All locking pins present and locked in place
  - If air powered--no air leaks
  - Check that fifth wheel not so far forward that tractor frame will strike landing gear during turns

Right Rear Tractor Wheels Area

- Dual wheels
  - Conditions of wheels and rims--missing, bent, broken spacers, studs, clamps, lugs

    - Condition of tires--properly inflated, valve stems and caps OK, no serious cuts, bulges, tread wear, tires not rubbing each other and no debris stuck between them
    - Tires same type, e.g., not mixed radial and bias types
    - Tires evenly matched (circumference)
    - Wheel bearing/seals not leaking
- Tandem axles
    - Whether tag, pusher or peg leg type
    - Repeat wheel/tire inspection as above

NOTE: Some may not have dual wheels, in which case pay particular attention to security of wheel mounting

- Suspension
    - Conditon of spring(s), spring hangers, shackles and U-bolts
    - Axle alignment
    - Powered axle(s) not leaking lube
    - Condition of torque rod arms, bushings
    - Condition of shock absorber(s)
    - If retractable axle equipped, check condition of lift mechanism, if air powered check for leaks
- Brakes
    - Condition of brake drum(s)
    - Condition of hoses - look for any chafing
    - Check slack adjusters
    - Check spring brakes

Rear of Tractor Area

- Frame and cross members not bent, cracked or otherwise damaged or missing
- Lights and reflectors
    - Tail lights, right turn signal light operating, clean, and proper color
    - License plate lamp clean, working
    - Reflectors clean and proper color
    - License plate(s) present, clean and secured
    - Splashguards (if required) present, properly fastened, not chaffing wheels
    - Air and electrical lines properly secured to frame, not damaged or chaffing

Trailer Frontal Area

- Air and electrical connections
    - Glad hands properly mounted free of damage, not leaking
    - Electrical line receptacle properly mounted, free of damage, plug adequately seated and safety catch engaged to prevent accidental disconnect
- License/registration holder present, securely mounted, cover closed

- Header board (if required)
  - Securely mounted, free of damage
  - Adequate to contain/hold cargo in the event of panic stop
- Canvas or tarp carrier (if so equipped)
  - Securely mounted and damage free
  - If carrying tarp, should be secure in the carrier, properly lashed down
- Lights and reflectors
  - Trailer nose clearance and identification lights, clean, operating and proper color
  - Reflectors, clean and proper color

Right Side of Trailer Area

- Front trailer support (landing gear or dollies)
  - Fully raised, no missing parts, not bent or otherwise damaged
  - Crank handle present and secured
  - If power operated, no air or hydraulic leaks
- Spare tire(s)
  - Carrier or rack not damaged, strong enough to carry load
  - Tire and/or wheel securely mounted in the rack
  - Tire and wheel condition adequate for a spare, proper size, properly inflated
- Lights and reflectors
  - Trailer side clearance lights clean, operating and proper color
  - Reflectors clean and proper color
- Frame and Body
  - Frame and cross members not bent, cracked, damaged or missing
  - Body parts not damaged or missing
- Cargo securement (will be discussed more fully in Unit 5.1)
  - Cargo properly blocked, braced, tied, chained, etc.
  - Side boards, stakes strong enough, free of damage, properly mounted (set) in place
  - Canvas or tarp (if required) properly lashed down to prevent water damage, tearing, billowing or blockage of mirrors
  - If over-width, all required signs must be safely and properly mounted and all required permits in driver's possession
  - Curbside doors securely closed, latched/locked, required security seals in place

Right Rear Trailer Wheels Area

- Dual wheels
  - Conditions of wheels and rims--missing, bent, broken spacers, studs, clamps, lugs
  - Conditions of wheels and rims--missing, bent, broken spacers, studs, clamps, lugs
  - Condition of tires--properly inflated, valve stems and caps OK, no serious cuts, bulges, tread wear, tires not rubbing each other and no debris stuck between them
  - Tires same type, e.g., not mixed radial and bias types

- Tires evenly matched (circumference)
- Wheels bearing/seals not leaking

Tandem axles
- Repeat wheel and tire inspection as above
- If equipped with sliding axles, check position and alignment, look for damaged, worn or missing parts, all locks present, fully in place and locked against fallout
- Flexible airlines not cracked, cut, crimped or otherwise damaged, secured against tangling, dragging, chafing

Suspension
- Condition of spring(s), spring hampers, shackles and U-bolts
- Axle alignment
- Condition of torque rod arms, bushings

Brakes
- Condition of brake drum(s)
- Condition of hoses, lines and valves
- Check slack adjustors
- Check spring brakes (if so equipped)
- Drain moisture from air tank, close petcock

Rear of Trailer Area

- Lights and reflectors
  - Rear clearance and identification lights, clean, operating and proper color
  - Reflectors clean and proper color
  - Taillights clean, operating and proper color
  - Right rear turn signal operating, and proper color
  - License plate lamp clean, working
- License plate(s) present, clean and secured
- Splash guards present, not damaged, properly fastened, not dragging on ground or chaffing tires
- Cargo securement
  - Cargo properly blocked, braced, tied, chained, etc.
  - Tailboards up and properly secured
  - End gates free of damage, properly secured in stake sockets
  - Canvas or tarp (if required) properly lashed down to prevent water damage, tearing, billowing to block either the rearview mirrors or to cover rear lights
  - If over length, or over width, are all signs and/or additional lights/flags safely and properly mounted and all required permits in driver's possession
  - Rear doors securely closed, latched/locked, required security seals in place

Left Rear Trailer Wheels Area

Check all items as done on right side except for air tank draining

Left Side of Trailer Area

Check all items as done on right side and check any traffic side doors

Left Saddle Tank Area

Check all items as done on right saddle tank area except for spare tire plus:

- Battery (if not mounted in engine compartment)
- Battery box securely mounted to vehicle
- Box has secure cover
- Battery(s) secured against movement
- Battery(s) case(s) not broken or leaking
- Fluid in battery(s) at proper level
- Cell caps present and securely tightened
- Vents in cell caps free of foreign material

Step 6. Check Signal Lights

Return to Cab

Turn off all lights
Activate stop lights
Activate left turn signal lights

Leave Cab and Check

Left front tractor turn signal light clean, operating and proper color
Left rear tractor turn signal light and stop lights, clean, operating and proper color
Left rear trailer turn signal and both stop lights, clean operating and proper color

Step 7. Check Air Brake System

Return to Cab

Turn off all lights
Check for all required documents, trip manifests, permits, etc.
Secure all loose articles in cab
They can interfere with operation of controls or become flying missiles in case of accident

Test Foot Brake

Take note of how much (if any) air pressure was lost while you were out of the cab
With engine off and parking brake released, apply treadle valve fully and see if air pressure drops more than 3 pounds in 1 minute (tractor only) or more than 4 pounds in 1 minute (for combination unit)
If loss exceeds this amount, there is a defect somewhere in the system

Test Low Pressure Alarm and/or Light

Start "fanning" off the air pressure by rapidly applying and releasing treadle valve

At approximately 60 pounds pressure, the low air pressure warning alarm and/or light should activate

Test Tractor Protection Valve

Continue to fan off the air pressure

At approximately 40 pounds pressure the tractor protection valve should automatically go from the "normal" to the "emergency" position

This action must cause the trailer brakes to lock up. If not, there is a defect in the system

Start Engine

Check how long it takes to build air pressure back up to the required pressure - approximately 105 to 115 pounds

Time to rebuild pressure should not take more than 3 to 3-1/2 minutes, if longer check it out with your supervisor

As air pressure was being built up, note if low air warning devices shut off at proper point

NOTE: Depending on how vehicle is equipped this step may have to be taken first due to draining the trailer's air tank earlier.

Fasten Safety Belt

Test Parking Brake

Allow vehicle to roll **slowly**

Slowly apply parking brake

If it doesn't stop vehicle, it is defective

Test Independent Trailer Brake

Allow vehicle to roll **slowly**

Pull down on trolley valve handle

If it doesn't stop vehicle, there is a defect in the system or air lines between the tractor and trailer may have been crossed

Test for Excessive Slack in the Fifth Wheel

Set independent trailer brake

Then **carefully** and **very gently** rock tractor in first and reverse gear while feeling/listening for excessive slackness in the kingpin locking jaws. If slackness seems excessive, check it out

Check proper operation of clutch during this procedure

Test Brake System Balance and Adjustment in Yard

- Build up speed to 5 to 7 miles per hour **maximum**
- Apply service brakes sharply
- Note vehicle "pulling" to one side or the other
- Note any mushy feeling and/or delayed stopping action
- If possible, perform this on sand or dirt area to detect any signs of nonoperating or misadjusted brakes (by examining marks in sand or dirt)
- If stopping rate or adjustment of brakes doesn't feel right, get it checked out right then and there -- don't take chances

Complete Pretrip Inspection Report Form (if required by employer)

- If vehicle has failed any of the above tests
  - Report it to your supervisor and let him determine cause and have necessary repairs made
- After any repairs/adjustments are made, repeat these tests again to see if the repairs have been done correctly
- If in doubt about the vehicle, don't take chances. Get professional repairs, advice before attempting to operate the vehicle
- If satisfied that the vehicle is free of safety defects, all reports made, vehicle is ready to operate

4. ENROUTE AND POST-TRIP INSPECTION (5 minutes)

Visual 16 Enroute and Post-trip Inspection Requirements

Enroute Inspection

General Inspection

- Pretrip inspection checklist can aid in performing enroute inspections
- Driver should make periodic walkaround for safety. Some cargo makes it mandatory to do this (see Section 397 of FMCSR)
- Even if not required by regulations, driver should make a visual walkaround every 150 miles or 3 hours for safety and the exercise will help keep you alert
- At every stop, check tires, brakes, turn signals, stoplights
- Make check of all lights before sunset

Monitoring Vehicle Operation

- It is driver's duty to continually monitor status of vehicle
  - Instruments
  - Air pressure system gauge
  - Temperature gauges
  - Pressure gauges
  - Ammeter/voltmeter
  - Mirrors
  - Tires

- Cargo, cargo covers
- Uses sense of sight, sound, smell and feel to detect any developing problems

Safety Inspection

- Walkaround inspection every 150 miles or every 3 hours (whichever comes first)
- Check following
  - Cargo doors and/or cargo securement
  - Tires -- Inflation and overheated
  - Brakes -- overheated
  - Coupling devices

Federal Requirements

- Certain enroute driver inspections are required by law
  - Cargo check (FMCSR 392.9)
    - If not a "sealed" trailer, within 25 miles after beginning of trip
    - Periodically afterward (every 150 miles or 3 hours)

  - Hazardous material cargo (FMCSR 397.17)
    - Inspect tires every 100 miles or 2 hours if vehicle has dual wheels
    - Identify, remove overheated tires -- immediately to prevent fire
    - Identify, repair or correct underinflated tires

Post-Trip Inspection

- Drain moisture from air tanks/fill fuel tanks (as required or permitted by employer)
- Identify any problems found during enroute inspection and/or discovered while driving, e.g., unusual noises, vibrations, etc.
- Conduct an inspection of the vehicle to further identify or locate these problems and/or to discover any newly developing malfunctions
- Identify/diagnose source (to be discussed in detail in Unit 4.3)
- Complete an accurate inspection report (to be discussed later)

5. ADDITIONAL PROCEDURES FOR SPECIAL VEHICLES (15 minutes)

Requirements for Special Vehicles

- Many different types of special vehicles
- Require additional inspection procedures
- Cannot describe all special vehicles
- Three common types will be briefly covered here
  - Twin trailers (double bottoms)
  - Tankers
  - Refrigerated units

Identify which of these vehicles, if any, will be taught at school

- For vehicles to be operated in this school
    - Students will perform inspection in Lab (Lesson 2)
    - Will be expected to perform as part of final test
- Vehicles not to be operated in this school
    - Procedures will be described here to alert students to special requirements
    - Actual inspection practice must be provided by employers

Visual 17 Additional Steps for Inspecting Twin Trailers

Inspecting Twin Trailers (Doubles)

Make normal pretrip inspection

Give special attention to following items:

- After hookup, check air lines and valves between the two trailers
- Valve position must be as follows:
    - Rear of lead trailer - OPEN
    - Rear of second trailer - CLOSED
    - Converter gear air tank valve - CLOSED

- Be sure air lines are properly supported and glad hands properly connected
- Hook up should be as follows:
    - Emergency line at front of converter gear to emergency glad hand at rear of lead trailer
    - Emergency line at rear of converter gear to emergency glad hand at front of second trailer
    - Make same check of service lines

- Check brake operation making sure that all brakes apply and release properly

If spare tire is carried on converter gear, make sure it's properly secured

Be sure pintle-eye of dolly is properly in place in pintle hook of lead trailer

Make sure pintle hook is properly latched

Safety chains should be properly secured to points of attachment on lead trailer

Be sure light cords are firmly in sockets on both front and rear trailers

Two chock-blocks should be available on unit at all times

Reinspect unit at each stop (as you would a single bottom) with special attention to
- Brake lines, and glad hands
- Electrical lines and connections
- Pintle hook latch and safety chains

Visual 18 Additional Steps for Inspecting Tankers

Inspecting Tankers

Make normal pretrip inspection

Pay special attention to
- Dome covers to tank compartments--closed and secured
- Hoses and pumps--fastened and secured
- Pumps free to turn
- All valves in off position and properly locked
- Tank dented or leaking
- Proper hazardous materials placards displayed (if applicable)

Inspection procedures will depend upon
- Tanker type
- Cargo being transported

Cargo varies from asphalt and roofing compound to milk and orange juice, with solvents, glues, acids, wines and chocolate in between

Because there are so many types of tankers and cargo is so diversified, inspection procedures will vary

Instructor should discuss with the class
- School's specific type of tanker
- Cargo it's designed to transport
- Any unusual characteristics
- Variations of normal inspection procedures

Visual 19 Additional Steps for Inspecting Refrigerated Vehicles

Inspecting Refrigerated Units (Reefers)

Make normal pretrip inspection

Check condition of trailer
- Holes in walls, ceiling or floor
- Damaged cold air circulation ducts
- Doors (properly locked and sealed)
- Any additional containers or compartments inside trailer
- Any rails or racks on ceiling (properly secured)

Check condition of refrigerator unit

- Water, oil and coolant level
- Suction pressure in compound gauge

Check fuel level in reefer fuel tank

Be sure fuel line from tank to refrigerator unit is properly secured and not leaking

Thermostat should be set at appropriate temperature (depending on type of cargo being transported)

Test run refrigeration unit for 30 minutes to an hour before loading (or as directed by your employer)

6. REPORTING YOUR FINDINGS (5 Minutes)

Visual 20 Example of Vehicle Condition Report

Taking Action

Safety inspection meaningless unless action taken to report and correct defects

Driver must learn to report findings to supervisor or maintenance department (as directed by company policy)

Makes oral report to mechanic (when necessary)
Always prepares a technically accurate, written report (required by law) for each vehicle operated, each day or work shift

Vehicle Condition Report

Vehicle Condition Report required by law for companies operating vehicles in interstate or foreign commerce (FMCSR 396.11)

Purpose

- There are many versions of vehicle condition reports based on one recommended by U.S. D.O.T. All serve the same purpose:
  - To serve as daily (or tour of duty) record of driver's findings
  - One to be kept in company files for a minimum of 90 days by the company
- One copy to be kept on vehicle (power unit) for at least 1 day
  - To alert the next driver to defects or problems reported by last driver, which should have been repaired
  - New driver reviews previous report and signs it to prove he/she has done so (FMCSR 396.13)

Driver is required to

- Fill out vehicle condition report in such a way that mechanic can understand nature of problem
- Driver required to report symptoms not be a diagnostician
- Review vehicle condition report made by previous driver
  - Check to see that defects were corrected before signing off

Problem in Reporting: Lack of Technical Knowledge

Often there is communication gap between driver and mechanic whether reporting verbally or by Vehicle Condition Report

Problem: Many drivers don't know enough about equipment to accurately describe defect

Solution: Learn about the equipment

Students will have practice "trouble-shooting" and reporting findings later in this course

Summary of Driver's Reporting Responsibilities

Student will learn now, throughout the training and later on the job:
- Procedures for inspection
- Recognizing symptoms of missing parts, imminent parts failures and/or failed parts
- Taking action
  - What actions are allowed
  - What actions driver is capable of
- Communication with mechanics in technically accurate way
- Followup on previous repairs by checking vehicle condition report of previous driver

7. SUMMARY AND REVIEW (20 minutes)

Inspection Practice

- Pretrip inspection will be demonstrated to students
- Each student will be given a chance to practice
- After initial practice, students will be required to
  - Perform or assist in inspection of vehicle(s)
  - Report any problems found
- By the end of the course, student will be expected to conduct good pretrip inspection, within 15 minutes without aid of instructors and identify and report all defects

Review Quiz

Allow time for students to complete quiz in Student Manual, Unit 1.3, and then discuss answers. A copy of the Review Quiz starts on the next page

UNIT 1.3 - REVIEW QUIZ

Part A - Consequences

In Column A, we have listed situations that could occur as a result of a vehicle defect or malfunction. Column B shows a step in a pretrip inspection. Match the step to the situation it might have prevented.

COLUMN A	COLUMN B
A situation you don't want to happen!	An inspection step that might have prevented that situation but was skipped!
____1. Engine failed and serious damage occurred as a result of lubrication loss.	A. Checked under front end of tractor for bent, worn or missing parts.
____2. Vehicle declared "out-of-service" because of defective steering.	B. Checked tire pressure with gauge and inspected tread wear.
____3. Pieces of cargo fell off trailer.	C. Conducted air pressure check of braking system
____4. A blowout in the right front tire, and vehicle ran off road	D. Looked under the vehicle, under the hood and checked dash instruments.
____5. Brakes reacted too slowly and accident occurred.	E. Inspected cargo chains.

Part B - Inspection Sequence

Listed below are seven steps in a pretrip inspection. Put them in an efficient sequence. (Number them 1, 2, 3, 4, 5, 6, 7)

____Shut down the engine, secure the vehicle and check the high low beams and 4-way flashers

____Raise the cab or hood and check the engine compartment

____Start the engine and check the instruments and controls and check for emergency equipment.

____Approach the vehicle and check its overall condition for damage and look for fluid leaks.

____Conduct a walkaround inspection with right turn signal on.

____Conduct a standing and rolling air brake system test and a last check of the instruments.

____Check operation of the left turn signal and the stop lights.

Part C - Federal Requirements

In addition to inspecting your vehicle to assure that it is in safe operating condition, Federal regulations require you to

(Place a "T" beside the statements that are true.)

____Complete a Vehicle Condition Report at the end of the day or tour of duty.

____Be able to repair the vehicle defects you identify.

____Inspect for hot tires and low tire pressure every 100 miles or 2 hours when pulling a cargo of hazardous material.

____Assure that you have a CB radio in working condition during pretrip inspection.

____Review the previous Vehicle Condition Report and see if the reported defects were corrected.

Notes:

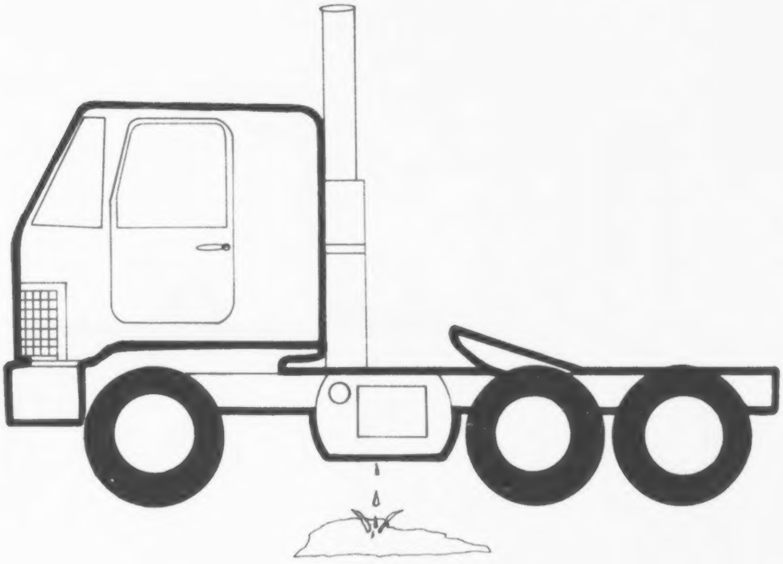
Goal of Inspection

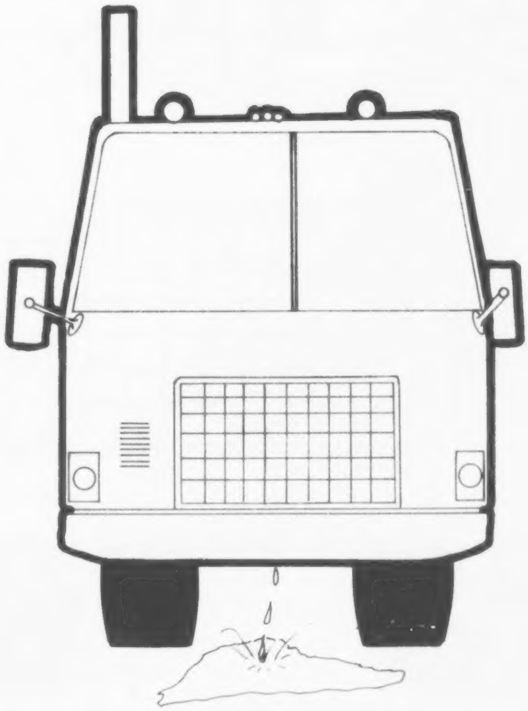
- Goals
  - –To Identify
    - A Part or System That Is Malfunctioning or Has Already Failed (or Is Missing)
    - A Part or System That Is in Imminent Danger of Failing or Malfunctioning
    - A Part or System That Is All Right or Is Functioning Properly
    - The Legal Requirements for Various Parts or System Conditions
- Driver Responsibility
  - –Safety of Vehicle and Cargo
  - –Vehicle Inspection
- Types of Inspection
  - –Pretrip
  - –EnRoute
  - –Post-Trip
- Basic Reasons
  - –Safety
  - –Economy
  - –Public Relations
  - –Legality
- Three Elements of a Good Inspection
  - –Knowing What to Look for
  - –Having a Consistent Way of Looking for It
  - –Being Able to Report Findings in a Technically Accurate Way So That Mechanic Will Be Able to Identify and Repair Problem

Visual 2

Example of Safety Defects:

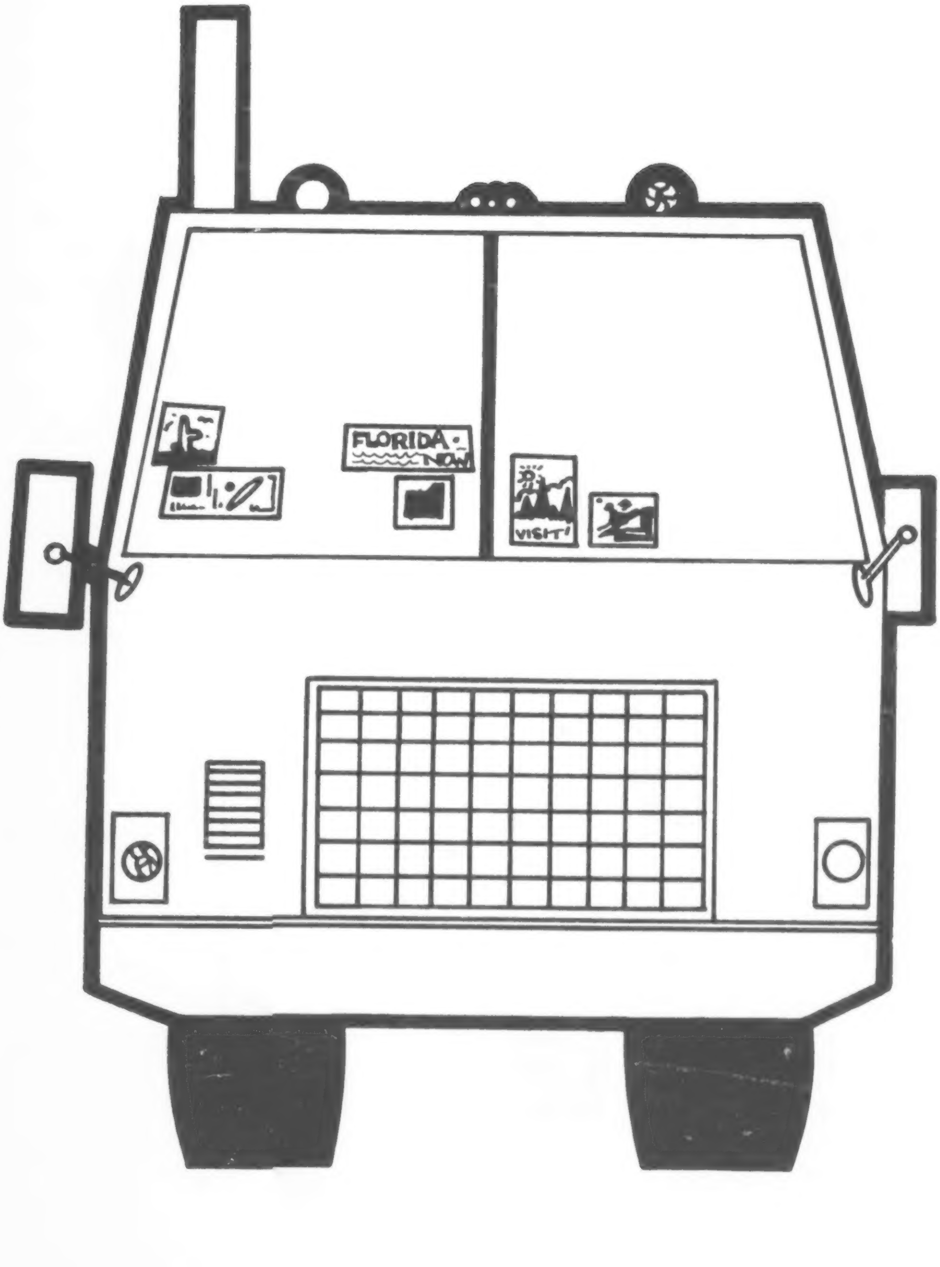
Fluid Leaks





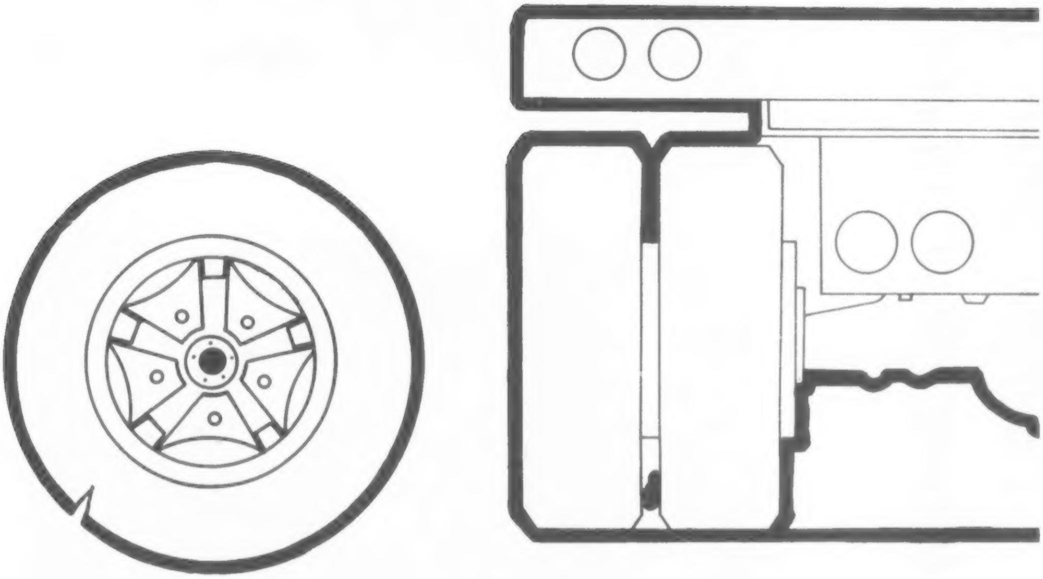
Visual 3

Example of Safety Defects:
Interference With Visibility


FLORIDA
NOW
VISIT!

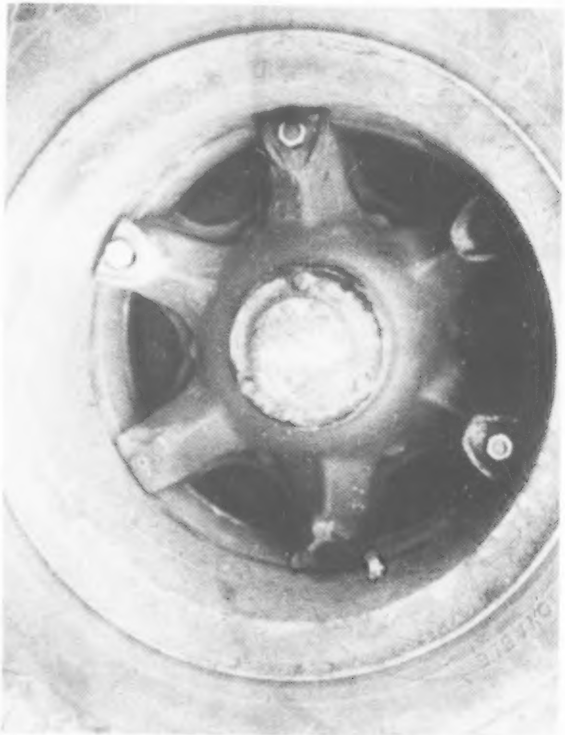
Visual 4

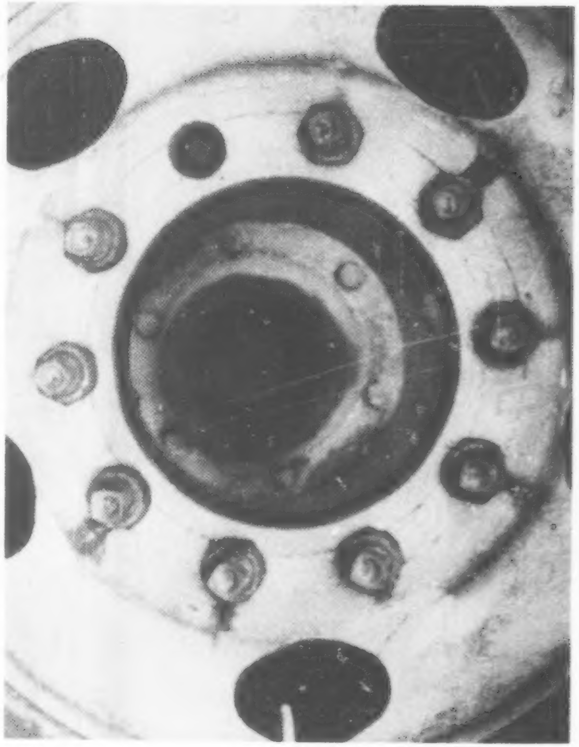
Example Safety Defects:
Damaged Tires



Example Safety Defects:

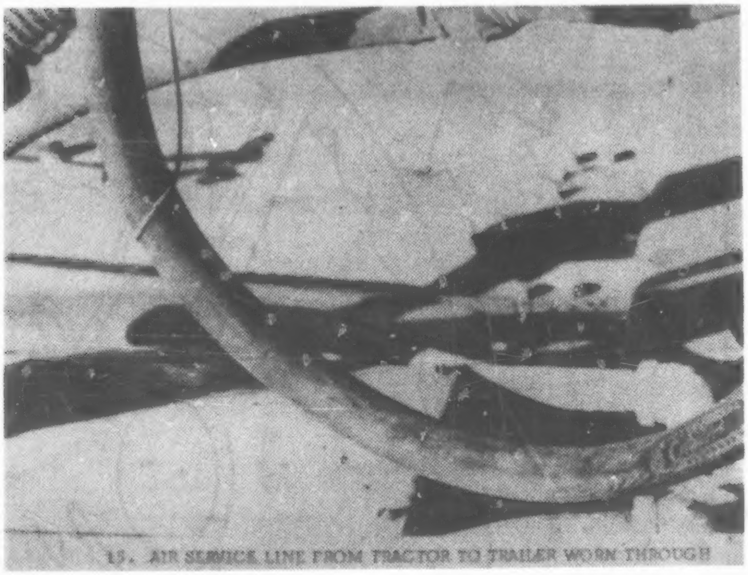
Missing Wheel Lug and Valve Stem



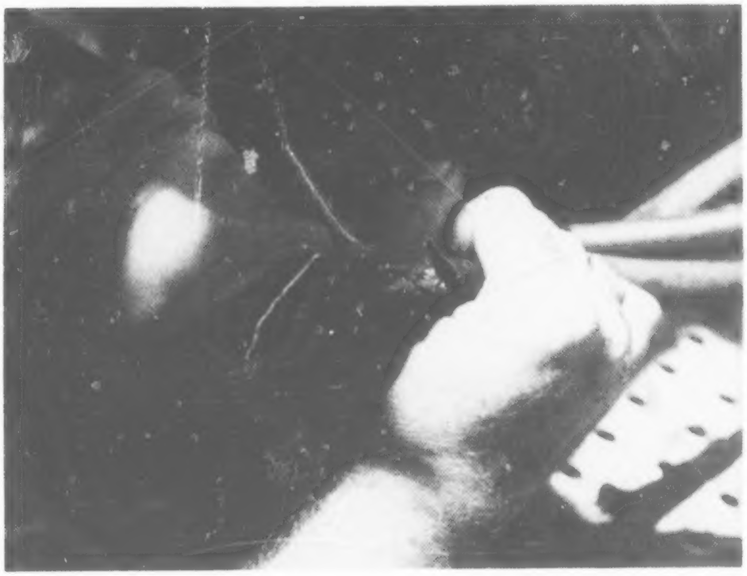


Example Safety Defects:

Chafed and Worn Air Hoses

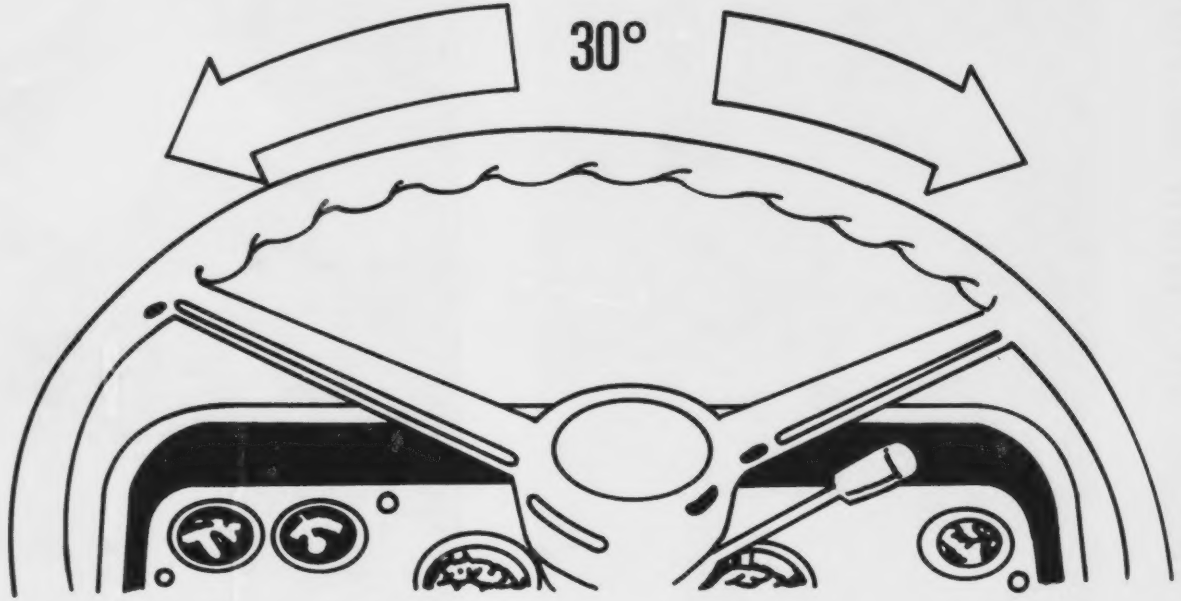


15. AIR SERVICE LINE FROM TRACTOR TO TRAILER WORN THROUGH



Example Safety Defects:

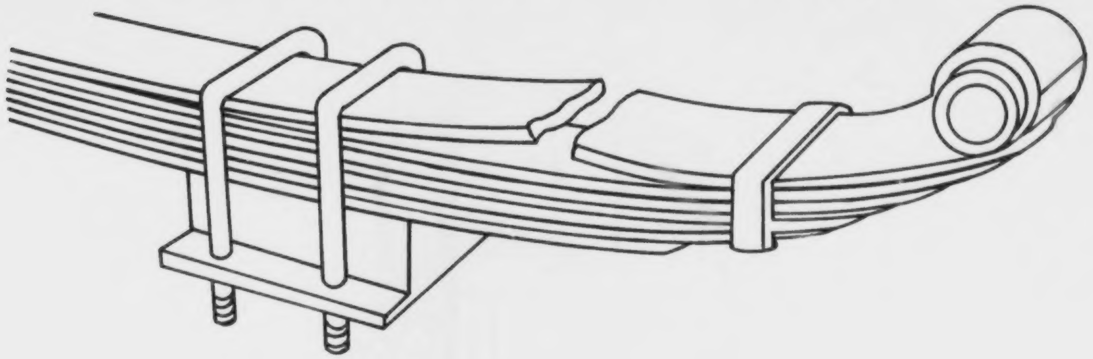
Excessive Steering Wheel Play

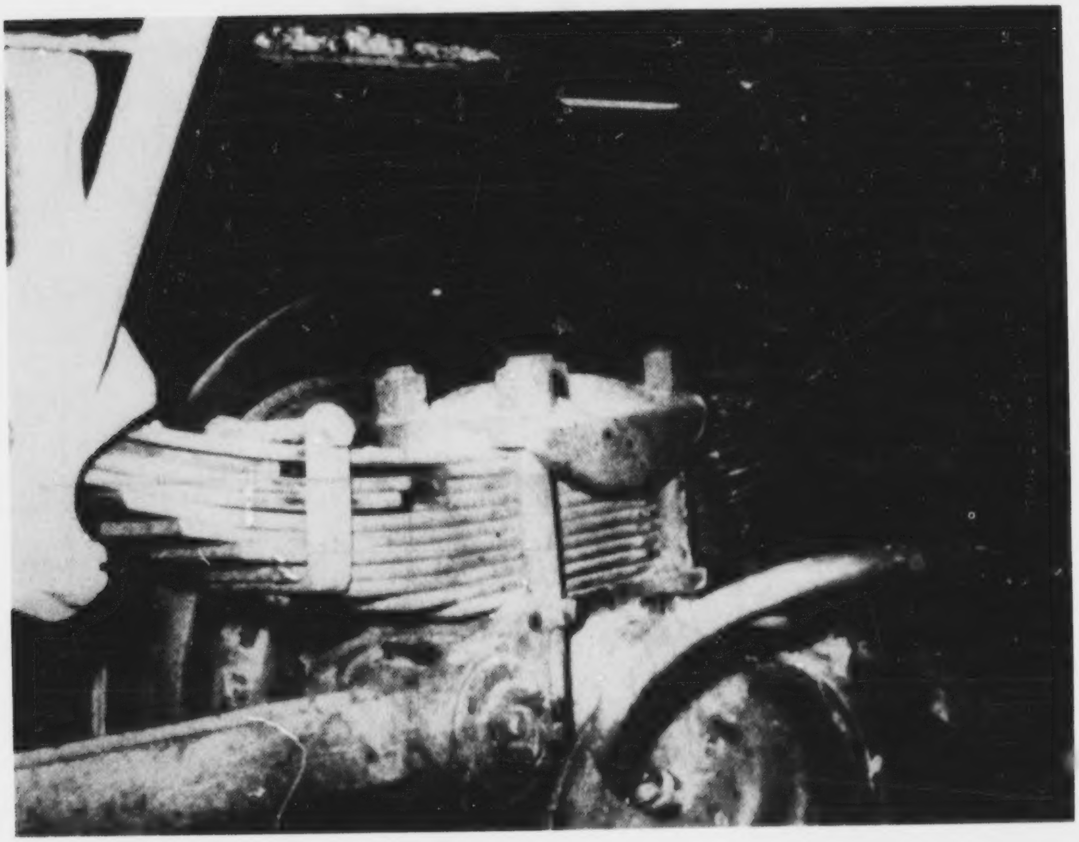


- 30° Is Allowed by Law
- 10° Is Unsafe

Visual 8

Example of Safety Defects:
Broken Leaves in Leaf Springs

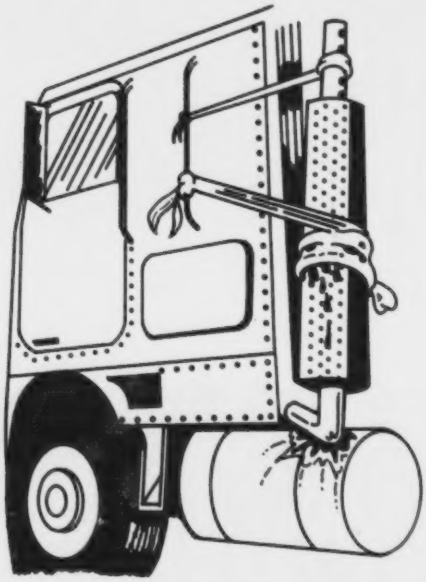


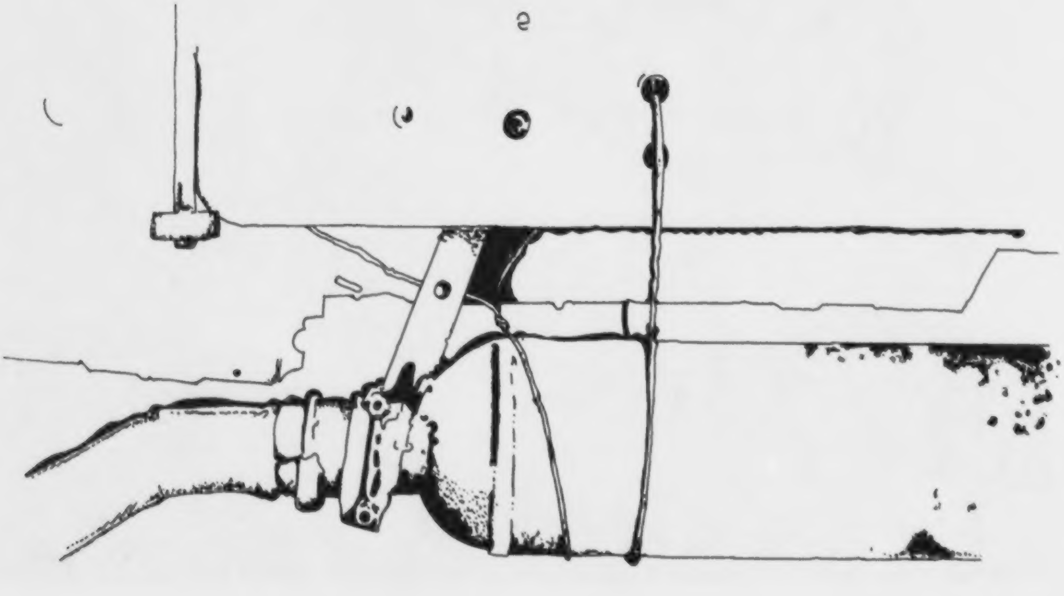


READEX FICHE

Visual 9

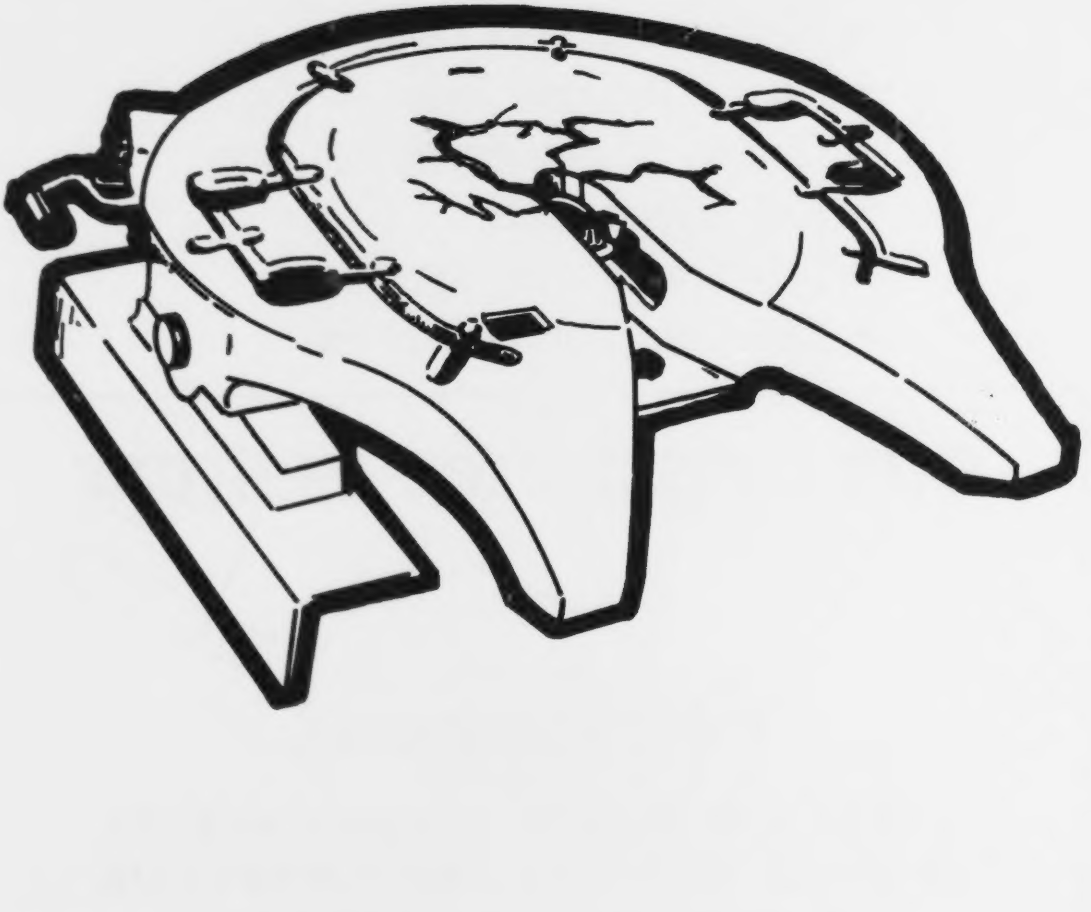
Example Safety Defects:
Exhaust System in Contact With the Fuel System





Visual 10

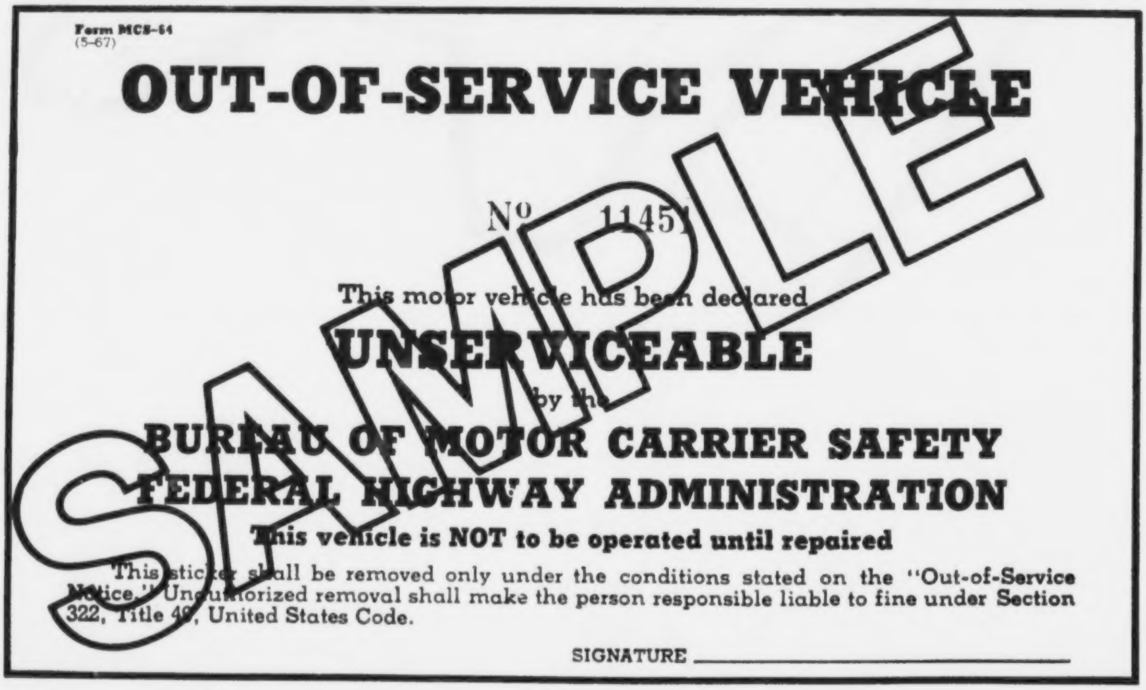
Evidence of Safety Defect:
Crack in Fifth Wheel



Visual 11

Out of Service Defects

- Defective Steering System
- Missing/Inoperative Brake Shoes
- Cracked Brake and Drums
- Serious Air Loss in Brake System
- Missing/Inoperative Lights
- Bald or Defective Tires
- Cracked Wheels/Missing Lug Nuts
- Fuel System Leaks
- Defective Coupling System
- Cargo That Can Shift or Fall



Form MCS-64
(5-67)

OUT-OF-SERVICE VEHICLE

Nº 11451

This motor vehicle has been declared

UNSERVICEABLE

by the

BUREAU OF MOTOR CARRIER SAFETY
FEDERAL HIGHWAY ADMINISTRATION

This vehicle is NOT to be operated until repaired

This sticker shall be removed only under the conditions stated on the "Out-of-Service Notice." Unauthorized removal shall make the person responsible liable to fine under Section 322, Title 49, United States Code.

SIGNATURE ____________________

SAMPLE

Characteristics of a Good Pretrip Inspection

Consistent

- Inspection Is Performed in the Same Sequence Each Time.
- Developing and Practicing a Consistent Sequence Will Improve the Quality and Efficiency of Inspection.

Efficient

- An Efficient Inspection Sequence Reduces Amount of Time Required for Inspection.

Thorough

- Not Possible to Conduct an Inspection as Thoroughly as a Trained Mechanic.
- It Is the Things That Drivers Can and Should Be Able to Spot That Are Most Likely to Cause Breakdowns and/or Accidents.
- A Checklist of Critical Items Should Be Thorough Enough to Ensure the Safety and Legality of the Vehicle.

Visual 13

Federal Motor Carrier Safety Regulations– Requirements for Inspection

- FMCSR 392.7
  - "No Motor Vehicle Shall Be Driven Unless the Driver Satisfies Himself That the Following Parts Are in Good Working Order."
    - Horn
    - Windshield Wiper
    - Steering
    - Service Brakes
    - Parking Brakes
    - Lights and Reflectors
    - Tires
    - Mirrors
    - Coupling Device
- FMCSR 392.8
  - Requires Check for Emergency Equipment
- FMCSR 392.9
  - Requires Inspection of Cargo Securement
- FMCSR 397
  - Requires Following Rules for Hazardous Materials and Required Placarding

Visual 14

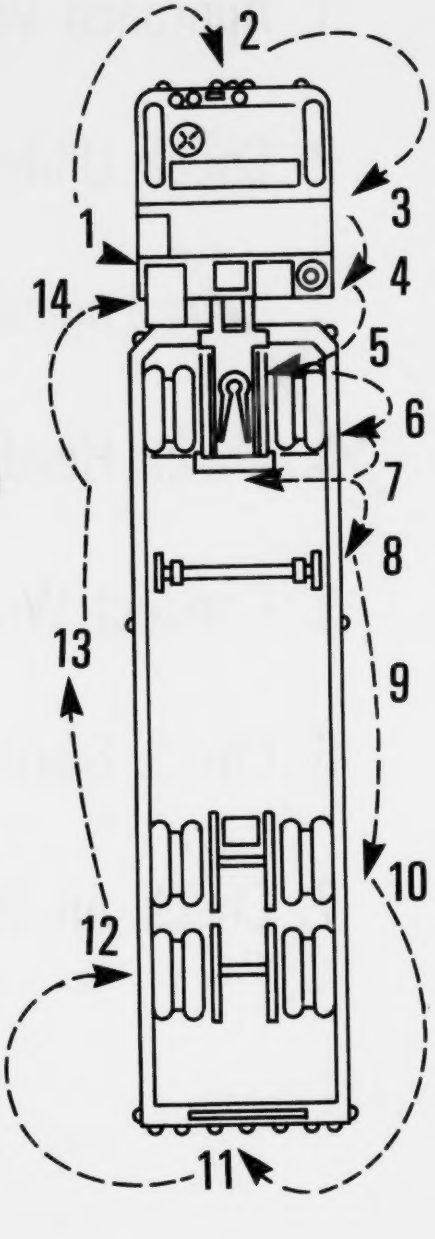
Seven-Step Pretrip Inspection Checklist

1. Approach Vehicle–Look for Leaks
2. Check Under Hood or Cab
3. Start Engine and Check Inside Cab
4. Check Headlights
5. Conduct Walkaround Inspection
6. Check Signal Lights
7. Check Air Brake System

Visual 15

Walkaround Sequence

1. Left Side of Cab Area
2. Front of Cab Area
3. Right Side of Tractor Area
4. Right Saddle Tank Area
5. Coupling System Area
6. Right Rear Tractor Wheels Area
7. Rear of Tractor Area
8. Trailer Frontal Area
9. Right Side of Trailer Area
10. Right Rear Trailer Wheels Area
11. Rear of Trailer Area
12. Left Rear Trailer Wheels Area
13. Left Side of Trailer Area
14. Left Saddle Tank Area



EnRoute and Post-Trip Inspection Requirements

EnRoute

- Monitoring
  - Instruments
  - Mirrors
  - Tires
  - Cargo
- Safety Check
  - Walkaround Every 150 Miles or 3 Hours
  - Check Tires and Brakes
  - Make Light Check Before Dark
  - Make Cargo Checks When Required
- Federal Requirements
  - FMCSR 392.9: Cargo Check Within 25 Miles
  - FMCSR 397.17
    - Hazardous Materials
    - Check Tires Every 2 Hours or 100 Miles, if Operating With Duals
      - Remove Overheated Tires
      - Get Underinflated Tires Repaired

Post-Trip

- Fill Out Vehicle Condition Report Which Identifies Any Needed Service

Visual 17

Additional Steps for Inspecting Twin Trailers

- Check Air Lines and Valves
  - Rear of Lead Trailer–Open
  - Rear of Second Trailer–Closed
  - Dolly Airtank Valve–Closed
- Be Sure Air Lines Properly Supported and Glad Hands Properly Connected
- Check Brake Operation
- Check Securement of Spare Tire and Converter Gear
- Be Sure Pintle-Eye of Converter Gear Is in Place and Pintle Hook Latched
- Check Safety Chains
- Check Light Cords
- Reinspect at Each Stop
  - Brake Lines and Glad Hands
  - Electrical Lines and Connections
  - Pintle Hook Latch
  - Safety Chains

Additional Steps for Inspecting Tanker Trailers

- Pay Special Attention to:
  - Dome Covers
  - Hoses and Pumps
  - All Valves in Off Position
  - Proper Hazardous Materials Placards
- Follow Special Rules for Inspecting by Type of Cargo Being Transported

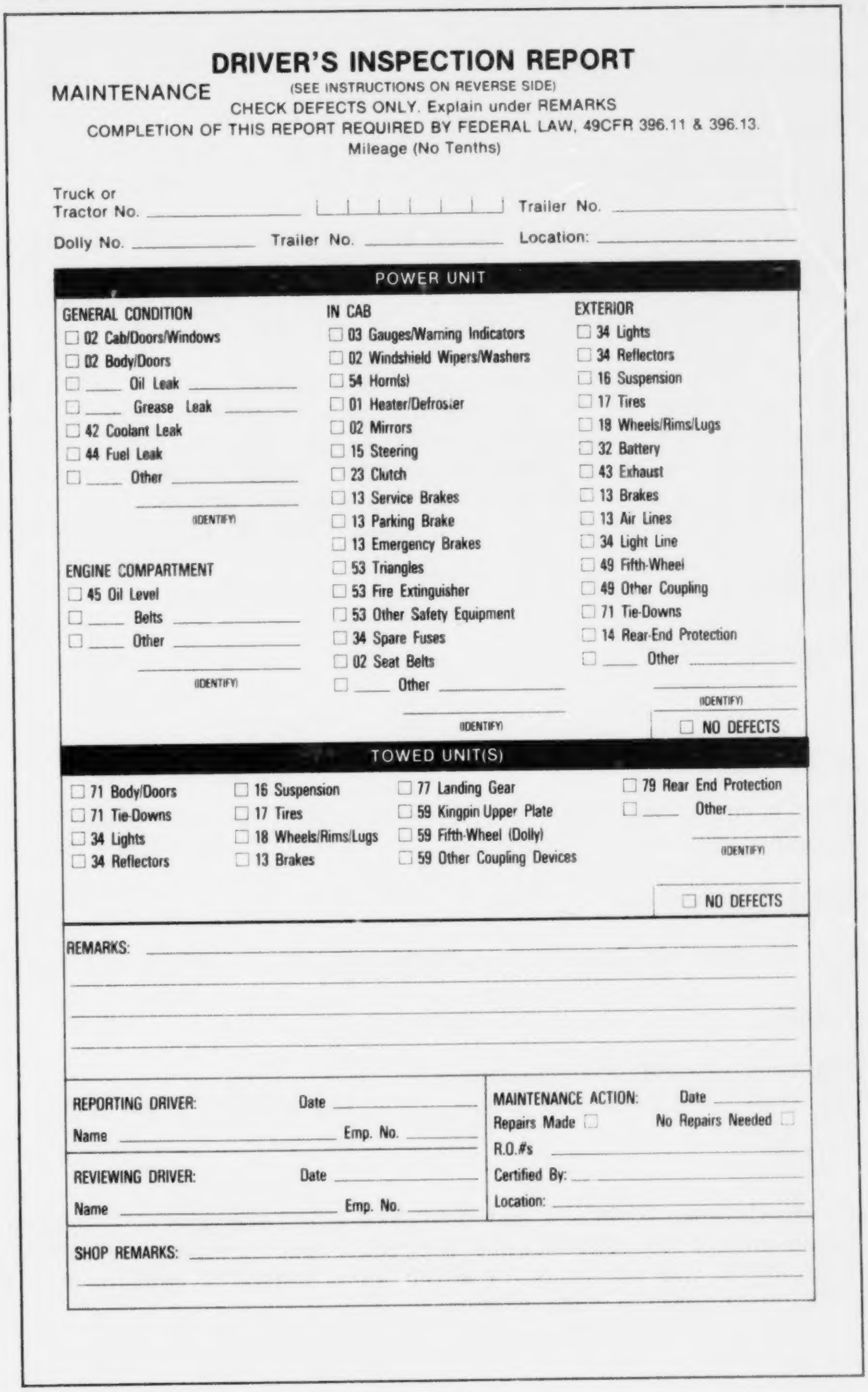
Additional Steps for Inspecting Refrigerated Trailers

- Check Condition of Trailer
    - Holes
    - Damaged Circulation Ducts
    - Doors Sealed and Locked
    - Additional Containers
    - Security of Rails and Racks
- Check Condition of Refrigeration Unit
- Check Fuel Level in Reefer Fuel Tank
- Make Sure Thermostat Is Set at Appropriate Temperature
- Run Unit 30 Minutes Before Loading

  Then Check
    - Temperature of Refrigeration Unit
    - Oil Pressure
    - Engine Temperature
    - Cycling of Unit
    - Manually Defrost, if Necessary

Visual 20

Example of Driver's Inspection Report



DRIVER'S INSPECTION REPORT

MAINTENANCE
(SEE INSTRUCTIONS ON REVERSE SIDE)
CHECK DEFECTS ONLY. Explain under REMARKS
COMPLETION OF THIS REPORT REQUIRED BY FEDERAL LAW, 49CFR 396.11 & 396.13.
Mileage (No Tenths)

Truck or Tractor No. ____________ |_|_|_|_|_|_|_| Trailer No. ____________

Dolly No. ____________ Trailer No. ____________ Location: ____________

POWER UNIT

GENERAL CONDITION
- ☐ 02 Cab/Doors/Windows
- ☐ 02 Body/Doors
- ☐ ____ Oil Leak ____________
- ☐ ____ Grease Leak ____________
- ☐ 42 Coolant Leak
- ☐ 44 Fuel Leak
- ☐ ____ Other ____________

____________ (IDENTIFY)

ENGINE COMPARTMENT
- ☐ 45 Oil Level
- ☐ ____ Belts ____________
- ☐ ____ Other ____________

____________ (IDENTIFY)

IN CAB
- ☐ 03 Gauges/Warning Indicators
- ☐ 02 Windshield Wipers/Washers
- ☐ 54 Horn(s)
- ☐ 01 Heater/Defroster
- ☐ 02 Mirrors
- ☐ 15 Steering
- ☐ 23 Clutch
- ☐ 13 Service Brakes
- ☐ 13 Parking Brake
- ☐ 13 Emergency Brakes
- ☐ 53 Triangles
- ☐ 53 Fire Extinguisher
- ☐ 53 Other Safety Equipment
- ☐ 34 Spare Fuses
- ☐ 02 Seat Belts
- ☐ ____ Other ____________

____________ (IDENTIFY)

EXTERIOR
- ☐ 34 Lights
- ☐ 34 Reflectors
- ☐ 16 Suspension
- ☐ 17 Tires
- ☐ 18 Wheels/Rims/Lugs
- ☐ 32 Battery
- ☐ 43 Exhaust
- ☐ 13 Brakes
- ☐ 13 Air Lines
- ☐ 34 Light Line
- ☐ 49 Fifth-Wheel
- ☐ 49 Other Coupling
- ☐ 71 Tie-Downs
- ☐ 14 Rear-End Protection
- ☐ ____ Other ____________

____________ (IDENTIFY)

☐ NO DEFECTS

TOWED UNIT(S)

- ☐ 71 Body/Doors
- ☐ 71 Tie-Downs
- ☐ 34 Lights
- ☐ 34 Reflectors
- ☐ 16 Suspension
- ☐ 17 Tires
- ☐ 18 Wheels/Rims/Lugs
- ☐ 13 Brakes
- ☐ 77 Landing Gear
- ☐ 59 Kingpin Upper Plate
- ☐ 59 Fifth-Wheel (Dolly)
- ☐ 59 Other Coupling Devices
- ☐ 79 Rear End Protection
- ☐ ____ Other ____________

____________ (IDENTIFY)

☐ NO DEFECTS

REMARKS: ____________

REPORTING DRIVER: Date ____________
Name ____________ Emp. No. ____________

REVIEWING DRIVER: Date ____________
Name ____________ Emp. No. ____________

MAINTENANCE ACTION: Date ____________
Repairs Made ☐ No Repairs Needed ☐
R.O.#s ____________
Certified By: ____________
Location: ____________

SHOP REMARKS: ____________

LESSON 2. VEHICLE INSPECTIONS: PRACTICE (LAB)

Overview

Time Allotted: 4 hours

Prerequisites: Lesson 1 of Unit 1.3

Purpose:

The purpose of this lesson is to demonstrate the pretrip inspection to a small group of students. Students will practice pretrip inspection procedures and will be critiqued by the instructor and other students. Vehicle defects will be "planted" before the practice.

The final part of the lesson occurs as students continue to develop their inspection skills in conjunction with other training activities. Students should conduct daily pretrip inspections on the vehicles that will be used for their range or onstreet training activities. This activity will also allow students to practice inspection in a wide variety of weather and settings, e.g., conducting an inspection at night.

Materials

Instructional Aids

None

Student Material

Pretrip Inspection Checklist, in Unit 1.3 of Student Manual
Walkaround Sequence Illustration, in Unit 1.3 of Student Manual

Instructor Material

Unit 1.3 - Pretrip Inspection Checklist (at end of this lesson)

Equipment

5-axle tractor-trailer (coupled)
Wiping rags, air pressure gauge, tire lug wrench, flashlight and pointer

Facilities

The initial demonstration and practice can take place in any area that is large enough to accommodate a tractor and trailer. Further practice will occur in the settings in which your school's routine daily pretrip inspections normally take place.

Content

Activity or Topic	Approximate Time
1. INSTRUCTOR DEMONSTRATION	1 hour
2. STUDENT PRETRIP INSPECTION PRACTICE AND OBSERVATION	3 hours
3. STUDENT PRETRIP INSPECTION PROFICIENCY DEVELOPMENT	**
	4 hours

** This is included in other lessons.

1. INSTRUCTOR DEMONSTRATION (1 hour)

Purpose

The purpose of this activity is for the instructor to demonstrate a pretrip inspection to a group of students. It is a detailed commentary style of demonstration and there is no student evaluation.

Range Layout

No specific layout is required.

Directions

1. Three students to one vehicle/instructor ratio.

2. Instructor will conduct a systematic commentary demonstration pretrip inspection of a coupled tractor-trailer, using the Pretrip Inspection Checklist as a guide. In carrying out the demonstration the instructor will describe:

   Each step of the 7-step inspection procedure as it is being performed

   The system and then the part that is being inspected

   The possible consequences of failing to inspect and/or failing to correctly determine the condition of a particular component

   How to recognize a
      Properly functioning component
      Component that is in imminent danger of failing or malfunctioning
      Component that has already failed or malfunctioned or is missing
   What characteristics of the component the instructor is seeing, feeling, sensing and his/her analysis thereof

3. Students follow along using their copy of the Pretrip Inspection Checklist and should ask questions if at any time they do not understand what the instructor is doing or why he/she is doing it and make notes on form regarding critical items and or highly technical points.

2. STUDENT PRETRIP PRACTICE AND OBSERVATION (3 hours)

Purpose

The purpose of this activity is to give each student initial practice in conducting a pretrip inspection.

Range Layout

No specific layout required.

Directions

1. Use a three to one student to vehicle/instructor ratio.

2. Make a list of vehicle defects prior to student practice inspection
   Inspect vehicle for actual defects
   Plant real or simulated defects

   Real defects--tires can be deflated, lights made inoperable, parts of vehicle left dirty, trailer door left unlocked, etc.

   Simulated defects--chalk marks on frame can simulate cracks, chalk marks on air lines can simulate cracked air line, etc.

3. Inform students of any methods used to simulate defects.

4. Students take turns practicing pretrip inspections, i.e., one inspects while the other two observe 1 hour allowed for each student, thus each 3 person team will require 3 hours to complete this lab session.

   Each student will

   Use inspection checklist as guide
   Ask instructor for assistance when necessary
   Call out each step during inspection for benefit of observers
   State component inspected and condition
   Identify defects, significance and what action should be taken

5. Instructor will conduct a student critique after each student inspection, by asking the observing students to critique by identifying:

   Defects that student practicing missed
   Errors or problems in procedure or sequence

6. Instructor will furnish feedback after student critique. Identify good points as well as errors.

7. Repeat until all students have chance for initial practice.

8. Plan separate range sessions for each practice (one 3-hour session can be very taxing and it would be difficult to plant new defects for each student)

Evaluation

Each student will be evaluated against the following criteria:

1. Completes inspection procedure in sequence taught using aids.
2. Identifies all defects and understands significance.

3. STUDENT PRETRIP INSPECTION PROFICIENCY DEVELOPMENT (Minimum 1 hour per student required - additional time dependent on student performance)

Purpose

The purpose of this activity is to develop student proficiency by conducting pretrip inspections. Proficiency will be measured by end-of-course evaluation standards listed below. Students will develop driving proficiency by inspecting vehicles prior to all daily range or onstreet activity. Practice should occur in a variety of settings including foul weather and nighttime inspections.

Directions

Students should

Continue practice in groups of three with one student inspecting while the other two observe and assist.

Gradually develop proficiency so that practice can be unsupervised and so that each student can conduct an inspection without the aid of the checklist or aid from others.

Work to improve their speed and efficiency once they have shown the ability to conduct a complete and thorough inspection every time.

Instructors should

Observe student performance as often as possible to give feedback. One instructor can observe inspection of several vehicles.

Plant defects or use other devices to assist student learning and to help them remain alert. This should be done after students have gained some proficiency and confidence. Some of the devices that can be used include:

Putting small pieces of masking tape over the telltale panel lights. If not removed during inspection, it is evidence that student did not monitor them.

Reversing the double frame lenses on the turn signal lights so that the red faces forward and amber to the rear.

Using the chalk marks to simulate defects. Use white chalk for less easily recognized defects such as cracks in frame.

Use yellow marks for more obvious defects. For example, you can place yellow chalk marks on the underside of the air lines. While the defect is easily recognized, the student must do a thorough inspection to see it.

Allow for unsupervised practice when student(s) have reached a level of proficiency that insures their safety around the vehicle.

Give immediate feedback when errors are spotted during or after pretrip inspection.

Be sure to identify any defects missed and state again the significance, e.g., if student fails to check for emergency equipment, point out that they would face additional hazards on the road if they broke down without emergency equipment.

Monitor for proficiency development towards evaluation standards and give additional training if necessary.

Observations

Students will have difficulty gaining proficiency in conducting Pretrip Inspections if they do not master and follow the seven-step procedure, do not recognize the significance of what they see or have a careless and/or indifferent attitude towards inspection. While these problems will show up in the results of their inspection efforts, there are many errors that can be observed that are symptomatic of those larger problems. Look for and correct the following kinds of errors:

Continual backtracking while inspecting.

Conducting a quick walkaround inspection and never bending down while inspecting.

Not cleaning license plate, lights and reflectors that can be reached, an indication that student is not checking these items.

Kicking tire or checking pressure visually instead of using gauge.

Not pulling on vee belts to check for tension.

Not grabbing steering linkage under front end to check for looseness.

Not taking vent caps off battery to check fluid level.

Not grabbing and shaking handle of closed cargo door to check for security of safety latch.

Evaluation

Student performance will be evaluated against the following criteria

Ability to conduct the seven-step pretrip inspection procedure:

- Consistently in the sequence taught
- Without the aid of checklists or the instructor
- Within 30 minutes after initial training and within 15 minutes by graduation
- Identifying all vehicle defects that need to be corrected prior to putting the vehicle on the road
- Properly reporting vehicle defects in writing

UNIT 1.3 - PRETRIP INSPECTION CHECKLIST

1. Approach Vehicle

Check general condition. Note fresh leaks.

2. Check Under Hood (or Cab)

First check that brakes are applied and/or wheels chocked. Oil level, coolant level, power steering fluid lines*, windshield washer fluid level, battery fluid level, connections and tiedowns, automatic transmission level*, engine oil makeup reservoir*, belts, leaks in engine compartment, wiring.

3. Start Engine and Check Inside Cab

Monitor Instruments--Oil pressure, ammeter/voltmeter, coolant temperature, air pressure, telltale lights, and warning buzzers.

Check Condition of Primary and Secondary Controls--Clutch, accelerator, brakes, transmission, horn, lights, climate controls.

Check Operation of Controls--Steering play, clutch free play, accelerator and brake pedals, horn, windshield wipers, climate controls, interior lights.

Check for Vision--Mirrors and windshields.

Check Emergency Equipment--DOT-required equipment, optional items such as tire-changing equipment, spare lamps, tools, etc.

Turn Off Engine and Leave Cab-- when air pressure has built to governor cut-out pressure, turn off engine, put transmission in lowest forward gear, set parking brake and turn on low beams and four-way flashers.

4. Check Lights

Check low and high beam operation and alignment, four-way flashers. Clean and adjust mirrors.

5. Conduct Walkaround Inspection

General--Turn off headlights and four-way flashers, turn on parking, identification and clearance lights. Activate right turn signals. Conduct walkaround in sequence indicated.

---

* If so equipped

PRETRIP INSPECTION CHECKLIST (Continued)

Left Side of Cab

Driver's door glass and door latches

Left front wheel, rim, tires, wheel bearing or hub oil seal and level

Left front suspension, spring(s), spring hangers, shackles, U-bolts, shock absorbers

Left front brake*, brake drum, hoses, check slack adjusters.

Front of Cab Area

Front axle, steering system, license plates, windshield, wiper arm tension, wiper blade rubber, lights and reflectors. Operation of right turn signal.

Right Side of Cab Area

Check all items as done on left side.

Operation of cab tilt mechanism.*

Right Saddle Tank Area

Right fuel tank(s), visible parts of rear of engine, transmission, exhaust system, frame and cross members, spare tire

Coupling System Area

Fifth wheel (upper and lower), air and electrical lines to trailer, sliding fifth wheel*

Right Rear Tractor Wheels Area

Dual wheels--wheels, rims, tires. Same type and evenly matched tires.

Tandem axles--repeat wheel and tire inspection. Also, check securing of wheel mounting for single wheels

Suspension--spring(s), spring hangers, u-bolts, torque rod arms, bushings, shock absorbers, alignment

Power axles*--not leaking. Retractable axle*--condition of lift mechanism

Brakes--brake drums, hoses. Check slack adjusters, spring brakes

Rear of Tractor Area

Frame and cross members, lights and reflectors, license plate, splashguards*--not chaffing wheels, air and electrical lines

Trailer Frontal Area

Air and electrical connections, license registration holder, header board secured*, canvas or tarp carrier secured*, lights and reflectors

Right Side of Trailer Area

Landing gear, spare tire(s)*, lights and reflectors, cargo securement and covering*, sideboards*, curbside doors secured*, if overwidth are signs mounted and permits in order, frame and cross members

---

* If so equipped

PRETRIP INSPECTION CHECKLIST (Continued)

Right Rear Trailer Wheels Area

Dual wheels--wheels, rims, tires. Same type and evenly matched.

Tandem axle--repeat tire and wheel inspection. Also check securing of wheel mounting for single wheels.

Sliding axle*--position and alignment. Flexible airlines, suspension spring(s), spring hangers, U-bolts, torque rod arms, bushings, shock absorbers

Brakes--brake drums, hoses,check slack adjusters and spring brake. Drain air tank, close petcock.

Rear of Trailer

Lights and reflectors, license plate(s), splash guard, cargo securement and covering*, overlength or overwidth signs*, additional lights/flags*, rear door secured, required seals in place*

Left Rear Trailer Wheels Area

Same as right rear wheel area except for draining air tank

Left Side of Trailer Area

Same as right side except for "side doors"* instead of "curbside doors"*

Left Saddle Tank Area

Same as right saddle tank area except for spare tire. Also check battery*.

6. Check Signal Lights

Turn off all lights. Activate stop lights and left turn signal lights and check condition and operation on both tractor and trailer

7. Check Air Brake System

Test Service Brakes

Note air pressure lost while out of cab. With engine off, apply foot pedal. Note if air pressure drops more than 3 psi in one minute (tractor only) or 4 psi in one minute (combination unit)

Test Low Pressure Alarm and/or Light

Fan off air pressure. At about 60 psi, low air pressure warning device should activate

Test Tractor Protection Valve

Continue fanning off air pressure. At approximately 40 psi, tractor protection valve should go from "normal" to "emergency" causing trailer brakes to lock up

---

* If so equipped

PRETRIP INSPECTION CHECKLIST (Continued)

Check Air Pressure Buildup
Start engine. Air pressure should build up to 105-115 psi within 3 to 3-1/2 minutes, note if low air warning devices shut off at proper time

Fasten Seat Belt

Test Parking Brake
Apply with vehicle rolling **slowly** to avoid damage

Test Trailer Brake
Apply with vehicle rolling **slowly** to avoid damage

Test for Excessive Slack in Fifth Wheel
Set trailer brake, **carefully** and **gently** rock trailer in first and reverse gears

Test Brake System Balance
Build up speed to 5 to 7 mph **maximum** and apply brakes sharply (in yard). Note any "pulling" or mushy feeling that indicates lack of proper adjustment

Complete Pretrip Inspection Report Form (if required by employer)

UNIT 1.4
BASIC CONTROL

UNIT 1.4 BASIC CONTROL

PURPOSE

The purpose of this unit is to prepare the students to safely perform five basic control maneuvers.

OBJECTIVES

Performance Objectives

Student must check the trailer coupling.

Students must be able to

- start, warm up and shut down the engine according to manufacturer's specifications.
- put the vehicle in motion and accelerate smoothly, forward and backward, with instructor's assistance.
- bring the vehicle to a smooth stop.
- back the vehicle in a straight line.
- position the vehicle for a turn and negotiate turns of various degrees and radii.

Knowledge Objectives

Students must know

- the procedures for starting, warming up and shutting down the engine; putting the vehicle in motion; and stopping.
- the consequences of excessive idling.
- the relationship of wheel base length, articulation and number of axles to path of a turn.
- the proper position from which to begin a turn and how to "set up," execute and recover from a turn.
- manufacturer's specifications for engine operation.

Skill Objectives

Students must be able to

- coordinate use of accelerator and clutch to achieve smooth acceleration and avoid clutch abuse.

- properly modulate air brakes to bring vehicle to a smooth stop.
- coordinate steering, braking, and acceleration to take the vehicle through a desired path forward and to back in a straight line.
- adequately judge the path trailer will take (off-tracking) as vehicle negotiates left or right curves and turns.

Attitude Objective

Students must believe that following correct starting, warmup, and braking procedures is essential to safe and economical vehicle operation.

LESSONS

Lesson 1.	**Introduction to Basic Control Maneuvers (Classroom)**	**45 minutes**
Lesson 2.	**Starting and Turning Off the Engine (Range)**	**35 minutes**
Lesson 3.	**Putting the Vehicle in Motion (Range)**	**1 hour 40 minutes**
Lesson 4.	**Turning the Tractor-Trailer (Range)**	**5 hours**

LESSON 1 INTRODUCTION TO BASIC CONTROL MANEUVERS (CLASSROOM)

Overview

Time Allotted: 45 minutes

Prerequisites: Unit 1.3

Purpose:

The purpose of this lesson is to review the basic procedures for starting, warming up, putting in motion, turning, stopping and shutting down vehicles. The lesson is primarily a preparation for the range activities that occur in Lessons 2, 3, and 4.

Materials

Instructional Aids

Visuals 1 - 14

Student Material

No additional material is required.

Instructor Material

Model (toy) tractor-trailer for demonstrations

Content

Activity or Topic	Approximate Time
1. STARTING, WARMING UP, AND SHUTTING DOWN THE ENGINE	20 minutes
2. PUTTING THE VEHICLE IN MOTION AND STOPPING	5 minutes
3. BACKING IN A STRAIGHT LINE	5 minutes
4. TURNING THE VEHICLE	15 minutes
	45 minutes

1. STARTING, WARMING UP, AND SHUTTING DOWN THE ENGINE (20 minutes)

Introduction

Definitions

Starting Procedure--steps involved in starting engine

Warmup--requirements for warming engine before it is moved
    Time period required
    Instrument readings must be within manufacturers prescribed operating range

Engine Shutdown--steps for shutting down an engine
    Includes cooling down period
    Particularly if equipped with a turbocharger (to prevent damage)

Idling--major waste of fuel, know engine requirements and do not idle excessively

Procedures Vary by Engine Type

Diesel and gasoline engines

Two-cycle and four-cycle types of diesel engines

Know the kind of engine in vehicle

Know basic procedures for engine

Serious Engine Damage Could Result with Improper Procedure

Visual 1 Steps in Starting a Two-Cycle Diesel Engine

Starting The Diesel Engine

Two-Cycle Types

- Apply parking brakes
- Place STOP and EMERGENCY STOP (if so equipped) controls in RUN position
- Depress clutch and move gearshift lever to neutral
- Increase hand throttle to idle position (if used)
- Turn switch-key on
- Depress clutch pedal
    - Prevents starting motor from turning transmission gears
- Operate starter
    - If engine does not start in 15 to 20 seconds, turn starter off at least 1 minute (to allow it to cool), then try again
- Control engine speed with foot throttle until it is running smoothly

  - Set hand throttle at 1/3 rpm operating range
  - Gradually reduce hand throttle to idle speed as engine warms
  - Check instruments for system malfunctions

Visual 2 Steps in Starting a Four-Cycle Diesel Engine

Four-Cycle Types

Apply parking brake

Close throttle
  - Pull out compression release valve (if applicable)
  - Depress clutch pedal

Turn switch key on
Operate starter
Crank for 3 or 4 seconds--close compression release
Check instruments
Warm up engine

Visual 3 Steps in Starting a Gasoline Engine

Starting the Gasoline Engine

Apply parking brake
  - Depress clutch and move gearshift lever to neutral
  - Set choke

Cold weather, pull all the way out
Warm weather, little or no choke required
Depress clutch
Turn ignition switch on
Operate starter--no more than 15 to 30 seconds at a time
Check instruments
Control engine with foot throttle and choke until it begins to run smoothly
Set hand throttle at fast idle

Fuel Efficient Starting

Don't "pump" throttle
  - Squirts gas into cylinder
  - Burns up when engine fires

Don't rev engine
Don't leave choke on any longer than necessary

Visual 4 Instrument Readings When Engine Warms Up

Engine Warmup

Operation at low rmp level (800-1,000 rpm)

Purpose

To allow engine to reach operating temperature
To allow lubrication oil to circulate
To reach favorable clearance between moving parts occurs at operating temperature

- To allow oil pressure to build up
- To establish oil film on cylinder walls
- To lubricate bearings
- To allow coolant temperature to increase before moving (may not show on gauge)
- To give oil temperature time to rise
- To allow air pressure to build up

Fuel-Efficient Warmup

- Minimize idling
  - Check owner's manual for idling time
  - Most manuals will allow engine to warm up while moving
  - A few minutes maximum idling time
- Keep rpm low
  - Avoid high rpm when accelerating in first gear
  - Shift to next highest gear as soon as possible
  - "Progressive shifting" discussed in next unit (Unit 1.5, Shifting)
- Keep speed down (not over 30 mph)

Consequences of Not Warming Up

- Rapid acceleration or over revving prior to warmup causes
  - Crankshaft and bearing damage
  - Turbocharger bearing damage (combination of turbochargers high speed operation and lack of proper lubrication)
  - Damage to most moving parts that haven't been properly lubricated

When Instrument Readings Reach Normal, Operate at Cruising Speeds and Accelerations

Instrument readings vary by type of engine
Driver should check instructions in operator's manual
EXAMPLES: Detroit, Cummins, Mack
Oil pressure - 40-80 PSI
Air pressure - 120 PSI
Water temperature - 175-220°
Oil temperature - 40° above coolant temperature
Ammeter - charge

Visual 5 Steps in Engine Shutdown

Engine Shutdown

Steps in engine shutdown vary slightly
Cooldown period is key step

Basic Steps in Turning Diesel Engine Off

- Depress clutch
- Move gearshift to neutral
- Cool engine down
- Turn switch key to off position

- If engine has stop control, move stop control to off position
  - Fuel flow is cut off from fuel injectors

Cooldown Period

- Cooldown period as important as warmup

- What happens in cooldown
  - Engine idles at least 5 minutes
  - Coolant and oil flow at reduced temperatures
  - Heat of highway driving is dissipated

- Cooldown period varies according to
  - Manufacturer's specifications
  - Type of trip just completed (e.g., longer period needed for high speed, over-the-road trip)
  - Type of load pulled, heavy vs. empty (e.g., hot, overworked engines require longer period)

- Engine damage could occur without cooldown

Shutting Down Gasoline Engine

- Cooldown period not as critical
- Depress clutch, place transmission in neutral
- Apply parking brake
- Turn ignition switch off
- Place transmission in lowest forward gear
- Chock wheels if necessary

Visual 6 Consequences of Excessive Idling

Excessive Idling

- Avoid excessive idling
  - Warmup
  - Cooldown
  - Today's engines do not need to idle beyond 5 minutes
  - Many truckers waste fuel with excessive idling
  - Fleet surveys show many trucks idle for long periods at truck stops
  - Most fleets cracking down on excessive idling practices via tachograph programs
- Excessive idling:
  - Wastes fuel
    - Vehicle is getting zero mpg
    - Idling can waste as much as 1/2 gallon an hour
  - Doesn't warm up entire vehicle
    - Transmission stays cool
    - Tires stay cool
  - Can foul (clog) fuel injectors
    - Engine not hot enough for complete combustion (fuel not fully burned)
    - Unburned fuel causes harmful deposits

2. PUTTING THE VEHICLE IN MOTION AND STOPPING (5 minutes)

Putting the Vehicle in Motion

Putting tractor-trailer in motion requires practice
Moving combination vehicle differs from car

Visual 7 Steps in Testing Tractor-Trailer Hookup

Testing Tractor-Trailer Hookup

Performed each time trailer is hooked up

Vehicles Equipped With Independent Trailer Brake Control

- Depress clutch, move gearshift to lowest forward gear
- Engage independent trailer brake control applying trailer brakes
- Release clutch to friction point
- Pull gently forward against locked trailer brakes
- Disengage clutch
- Repeat procedure

NOTE: This also shows whether or not trailer brakes are working.

Vehicles Without Independent Trailer Brake Control (Hand Valve)

- Depress clutch, move gearshift to lowest forward gear
- Switch tractor protection valve from "normal" to "emergency"
- Partially engage clutch and pull forward gently against locked trailer brakes
- Repeat procedure

Visual 8 Steps in Putting Tractor-Trailer in Motion

Putting Tractor-Trailer in Motion

A skill learned by practice

Steps

- Depress clutch fully, place transmission in lowest forward gear
- Increase engine rpm's slightly (gas engines only)
- Release clutch to "friction point"
  - Point where clutch engages
  - Decrease in rpm is sign that friction point has been reached
  - Gradually release clutch until it is fully engaged
- When vehicle starts to move (diesel engines only) gradually increase engine rpm to increase vehicle speed
- When vehicle is in motion with clutch fully engaged take left foot off clutch until ready to shift again or stop
- Avoid excessive clutch slipping, engage as quickly as possible without stalling engine

Starting on an Upgrade

Set the independent trailer brakes (if so equipped)
Gradually release clutch and at same time release trailer brakes or parking brake as clutch engages

Visual 9 Steps in Stopping a Tractor-Trailer

Stopping the Tractor-Trailer

Skill learned by practice

Steps

Release accelerator pedal
Depress brake pedal for maximum valve opening
As the vehicle begins to slow, decrease brake pedal pressure
Stop vehicle smoothly by releasing brake pressure in relation to vehicle stopping rate
As vehicle halts, release pedal completely
Depress clutch pedal as vehicle halts
After halting, place gearshift lever in neutral
    Reapply brake just enough to keep vehicle stationary
    Release clutch pedal

Signs of a Good Stop

Students should be able to stop smoothly
No nose rebound
No loud sound of compressed air being vented

3. BACKING IN A STRAIGHT LINE (5 minutes)

NOTE: Detailed backing maneuvers discussed in Unit 1.6. Information presented here only to prepare students for straight line backing required in Lesson 3 of this Unit and during shifting exercises in Unit 1.5, use model tractor-trailer to demonstrate.

Visual 10 Steps in Straight Line Backing

Backing

Difficult maneuver, details on various backing maneuvers taught later
Straight line backing, simplest backing maneuver

Step 1: Position Vehicle Properly

Put in position by moving forward until tractor-trailer is aligned and front (steering) wheels are straight

Step 2: Speed

Put vehicle in reverse
Back as slowly as possible (use idle speed)
Don't ride clutch or brake pedals

Step 3: Checking Behind

Constantly check behind when backing
Keep doors closed, always check both mirrors
Make maximum use of mirrors to detect persons/objects crossing into intended path

Step 4: Steering

- Keep vehicle on path
- Do not oversteer
- Correcting drifts
  - Turn steering wheel in direction of drift as soon as it occurs
  - Do not oversteer, only slight movement required if caught right away
  - Little drifts need small correction; big drifts need big ones
  - Use push-pull method of steering to keep trailer in line
- Simple method of steering to keep the combination in line is
  - When trailer gets bigger in mirror, push steering wheel towards that mirror, i.e., towards left (if left mirror)
  - Immediately straighten steering wheel out again
  - If late in catching larger image of trailer, push wheel more to correct
- Biggest error in push-pull method--not returning wheel to straight ahead position immediately

Step 5: Pull Up and Start Again if Too Far Out of Position

Easier to make corrections moving forward (i.e., get the vehicle back in proper position)
When it is not necessary to stop, pull up and make corrections in steering path

4. TURNING THE VEHICLE (15 minutes)

Will describe basic turning maneuver

- Additional instruction takes place in Unit 2.4, Space Management (use model tractor- trailer)
  - Handling turns in traffic
  - Special maneuvers for special circumstances

Basic Rules for Turning

Know the vehicle
Plan in advance
Allow for off-tracking

NOTE: Use model tractor-trailer to demonstrate tracking when taking turns, in lieu of Visuals 11 through 14.

Visual 11 Off Tracking Characteristics of Straight Truck vs. Tractor-Trailer

Off-Tracking

Definition and Importance

- Condition that occurs in all four-wheel vehicles
- Rear wheels follows shorter path than front wheels, i.e., "off the track" of the front wheels
- Off-tracking increased by
  - Greater distance between front and rear wheels
  - Sharper turns
- Important consideration when making turns or curves, i.e., path taken by rear vehicle wheels as important as path taken by front wheels

Off-Tracking in Tractor-Trailer Combination

- Two key factors determine off-track of trailer
  - Distance between kingpin and rear trailer wheels
    - Greater the distance the greater the off-tracking
    - Single axle trailers--distance is measured from center of kingpin to center of rear axle
    - Tandem axle trailer--distance is measured from center of kingpin to imaginary center point between the axles
  - Amount of sideway drag of rear tires
    - Sideway drag increases with number of rear tires and distance from kingpin
    - The more sideway drag, the greater the axle tracking
    - Tandem axles have more sideway drag and greater off-tracking than single rear axle
- Effects of off-tracking of trailer must be taken into consideration when taking turns or curves

Visual 12 Making Right Turns

Steps in Making Right Turns with Tractor-Trailer

- Adjust speed on approach to intersection
  - Avoid need to brake during turn
  - Allow for slight acceleration
- Shift into proper gear
  - Complete turn in same gear
  - Allows both hands to remain on wheel
- Get into proper position
  - Semi-trailer must pull further into the intersection to avoid crossing over the curb
  - Rule of thumb: get approximately one half the length of the rig past the corner point of intersection before beginning the turn
  - Keep vehicle wheels straight prior to executing the turn

Turn steering wheel to the right and complete turn
Accelerate slightly for smooth turn
Watch right mirror during turn
    For position of trailer wheels
    For vehicles attempting to pass
Turn steering wheel back to the left to straighten wheels

Errors in Making Right Turns

Approaching the intersection too fast
Failure to gear down before turn
Shifting gears while in the in turn
Failure to allow for off-tracking of the rear wheels of trailer, i.e., not getting far enough into the intersection before making the turn

Visual 13 Making Left Turn

Steps in Making Left Turn

Reduce speed approaching intersection
Select proper gear for completing entire turn and keep wheels straight
Turn to the left from as far right as possible to allow trailer to clear turn well
Watch left mirror during the turn
Turn steering wheel back to the right to straighten wheels

Errors in Making Left Turn

Approaching intersection too fast
Shifting gears in turn

Visual 14 Right and Left Highway Curves

Right and Left Highway Curves

Positioning for a curve is important

Right Curve

Keep the front of vehicle toward the center of the road

Failure could result in rear of vehicle running off the road (off-tracking)

Left Curve

Keep tractor as close to outer edge of road as possible to prevent trailer from running over the centerline of the road

Range Preparation

Students will have three range lessons.

Lesson 2--Starting and Turning Off the Engine

To provide practice and proper procedures for starting, warming, and shutting down the engine

Lesson 3--Putting the Vehicle in Motion

To provide students practice in putting the vehicle in motion, testing the tractor-trailer hookup, moving forward and backward in a straight line, and stopping

Lesson 4--Turning the Tractor-Trailer

Seven exercises, arranged in order of difficulty, are provided to give practice in turning the tractor-trailer:

Exercise 1--Serpentine
Exercise 2--Figure 8
Exercise 3--Restricted Figure 8
Exercise 4--Turns
Exercise 5--Restricted Turns
Exercise 6--Sharp Turns
Exercise 7--Combination Turns

Each exercise has been designed to help the student acquire the necessary turning skills to operate a tractor-trailer in everyday over-the-road travel.

Each exercise will be demonstrated by the instructor and then practiced by the student.

NOTE: Allow time for students to review diagrams of turning exercises in their student manual. Answer any questions.

Steps in Starting a Two-Cycle Engine

Starting Procedures–Two-Cycle Diesel

1. Set Parking Brake.
2. Disengage Clutch and Move Gearshift to Neutral Position
3. Place the STOP and EMERGENCY STOP Controls in the RUN Position.
4. Increase Throttle to Idle Position.
5. Turn Switch-Key to ON Position.
6. Depress Clutch Pedal (to Prevent Starting Motor From Turning the Transmission Gears).
7. Operate Starter (if Engine Does Not Start in 30 Seconds, the Key/Button Should Be Released and Another Attempt Should Be Made After One Minute. This Allows Starter Motor to Cool.)
8. Control Engine With Foot Throttle Until It Is Running Smoothly.
9. Set Hand Throttle at 1/3 of Operating RPM Range.
10. Warm Up Engine for About 1-3 Minutes at Approximately One-Third Operating Range.

Steps in Starting a Four-Cycle Diesel Engine

1. Set Parking Brake.
2. Disengage Clutch and Move Gearshift to Neutral.
3. Close Throttle.
4. Pull Out Compression Release Valve, If So Equipped.
5. Depress Clutch Pedal (to Prevent Starting Motor From Turning the Transmission Gears).
6. Turn Switch Key to ON Position, if So Equipped.
7. Operate Starter. If Engine Does Not Start in 30 Seconds, the Key/Button Should Be Released and Another Attempt Should Be Made After One Minute. The Rest Period Allows Starter Motor to Cool.
8. After 3 or 4 Seconds of Cranking, Close Compression Release.
9. Check Instruments.
10. Warm Engine Up for About 1-3 Minutes at Approximately One-Third the Operating RPM Range.

Steps in Starting a Gasoline Engine

1. Apply Parking Brake.
2. Disengage Clutch and Move Gearshift to Neutral Position.
3. Set Choke According to the Following (if Applicable)
    a. In Cold Weather, Pull Choke All the Way Out.
    b. In Warm Weather, Little or No Choking Is Required.
    c. Use Choke Sufficiently to Keep Engine Running Smoothly.
4. Depress Clutch Pedal.
5. Turn Ignition Switch On.
6. Operate Starter. (if Engine Does Not Start Within 30 Seconds, Allow Starter Motor to Cool a Few Minutes Before Repeating Starting Procedure).
7. Check Instruments for Normal Readings.
8. Control Engine With Foot Throttle and Choke Until It Begins to Run Smoothly.
9. Set Hand Throttle at Fast Idle and Allow Engine to Warm Up to About 1/2 to 3/4 of Normal Operating Temperature.

Visual 4

Instrument Readings When Engine Warms Up

- Instrument Readings Vary By Type of Engine and Manufacturer
- Examples:

Normal Instrument Readings for A Two-Cycle Diesel

Oil Pressure:	40-60 psi
Air Pressure:	105-120 psi. Should Be at the Maximum Before Moving Vehicle
Water Temperature:	At Least 140° F Before Moving 160°-185° F Under Normal Driving Conditions
Ammeter:	Should Be in Charging Position

Normal Instrument Readings for A Four-Cycle Diesel

Oil Pressure:	40-80 psi After Warm-Up
Oil Temperature:	140° After Warm-Up 180-225° During Normal Highway Driving
Water Temperature:	175-180° After Warm-Up 170-190° for Maximum Efficiency 165 Absolute Minimum Temperature for Highway Driving Coolant Temperature Should Never Exceed 200° F for Any Length of Time
Ammeter:	Should Be in Charging Position
Air Pressure:	Should Reach Maximum of 105-120 psi Before Vehicle Is Moved

Visual 5

Steps in Engine Shutdown

- Procedures Vary by Type of Engine and Manufacturer
- General Procedure
  - Depress Clutch
  - Move Gearshift to Neutral
  - Cool Engine Down
  - Turn Switch-Key to Off Positon
- Importance of Cool Down Period
  - Required to Dissipate Heat of Highway Driving
  - Manufacturer Specifies Cool Down Period
  - Longer Periods Required
    - After Long Trips
    - After Pulling Heavy Loads
    - With Turbochargers
- Always Check Requirements for Cool Down
  - Engine Damage Could Result From Lack of Proper Cool Down Period!

Visual 6

Avoid Excessive Idling

- Most Engines Do Not Need to Idle Beyond 5 Minutes
- Many Truckers Waste Fuel With Excessive Idling
- Truck Fleets Cracking Down on Truckers Who Let Trucks Idle at Rest Stops
  - Tachograph Programs Detect Excessive Idling
- Know Your Engine's Idling Requirements and Stick to Them!
- Dangers:
  - Wastes Fuel
  - Doesn't Warm Entire Vehicle
  - Can Foul Fuel Injectors

Steps in Testing the Tractor-Trailer Hookup

- With Independent Trailer Brake
  - Put in Lowest Forward Gear
  - Apply Independent Trailer Brake
  - Pull Gently Against Locked Trailer Brakes
  - Disengage Clutch
  - Repeat Procedure
- Without Independent Trailer Brake
  - Put Into Lowest Forward Gear
  - Put Tractor Protection Valve Into "Emergency" Position
  - Pull Gently Against Locked Trailer Brakes
  - Disengage Clutch
  - Repeat Procedure

Putting the Tractor-Trailer in Motion

- A Skill Learned in Practice
- Place in Lowest Forward Gear
- Increase Engine RPM's Slightly
- Release Clutch to "Friction Point"
- Gradually Speed Up Engine to Move Load
- Release Clutch Completely

Stopping a Tractor-Trailer

- A Skill Learned by Practice

Steps

- Release Accelerator Pedal
- Depress Brake Pedal for Maximum Valve Opening
- Decrease Brake Pressure as Vehicle Begins to Slow
- Stop Vehicle Smoothly by Releasing Brake Pressure
- Release Pedal Completely as Vehicle Halts
- Disengage Clutch
- Place Gearshift in Neutral and Reapply Brake to Keep Vehicle Stationary

Signs of a Good Stop

- Smooth
- No Nose Rebound
- No Loud Sound of Compressed Air

Visual 10

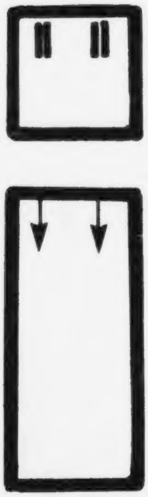
Steps in Straight Line Backing

1. Position Vehicle Properly

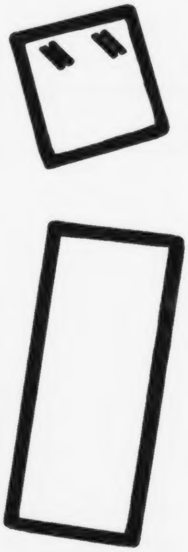
2. Back as Slowly as Possible

3. Constantly Check Behind With Mirrors

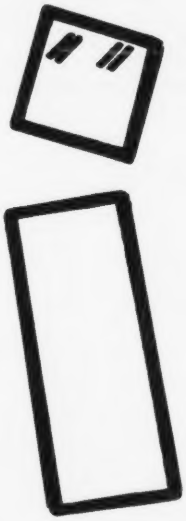
4. Use Push-Pull Method of Steering
   –When Trailer Gets Bigger in One Mirror, Push Steering Wheel Towards Mirror to Correct Drift



Backing
Straight



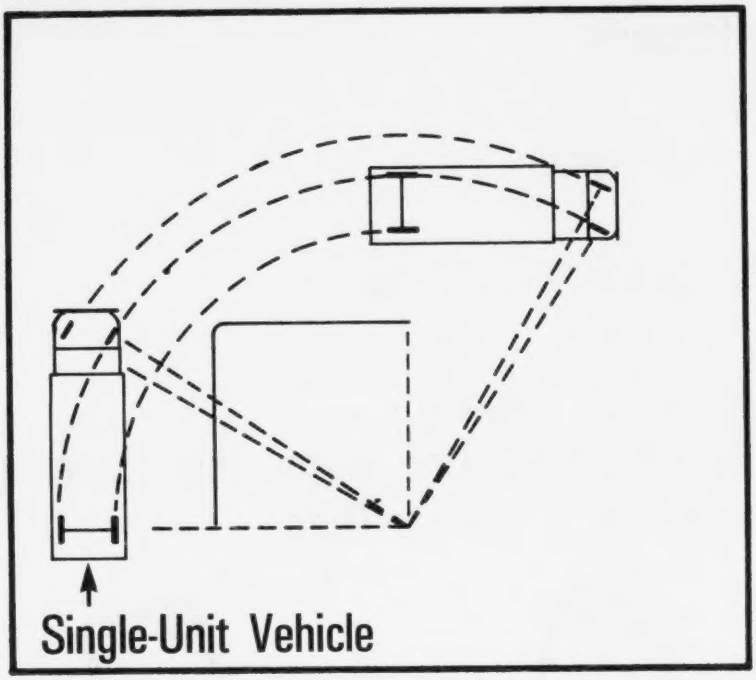
Turning Toward Left
Mirror Corrects
Left Drift

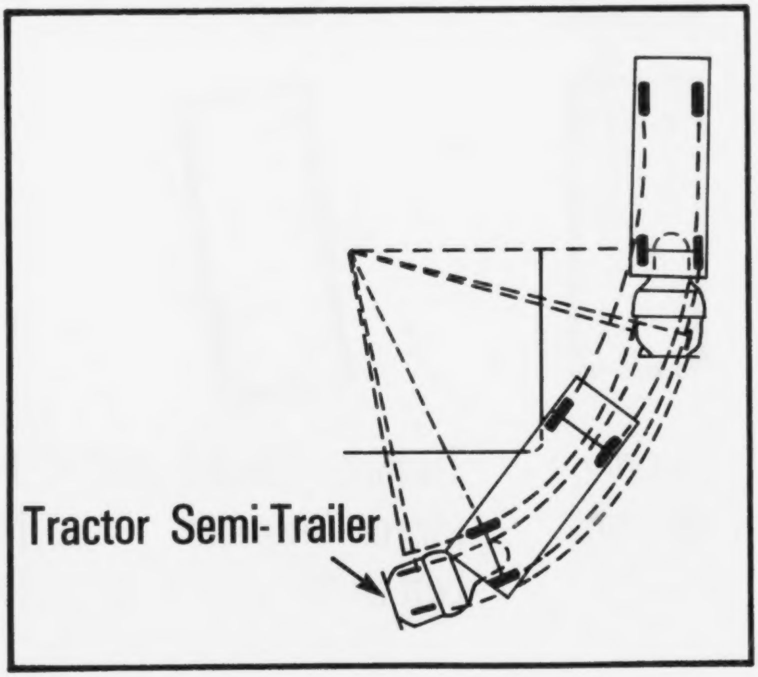


Turning Toward Right
Mirror Corrects
Right Drift

Visual 11

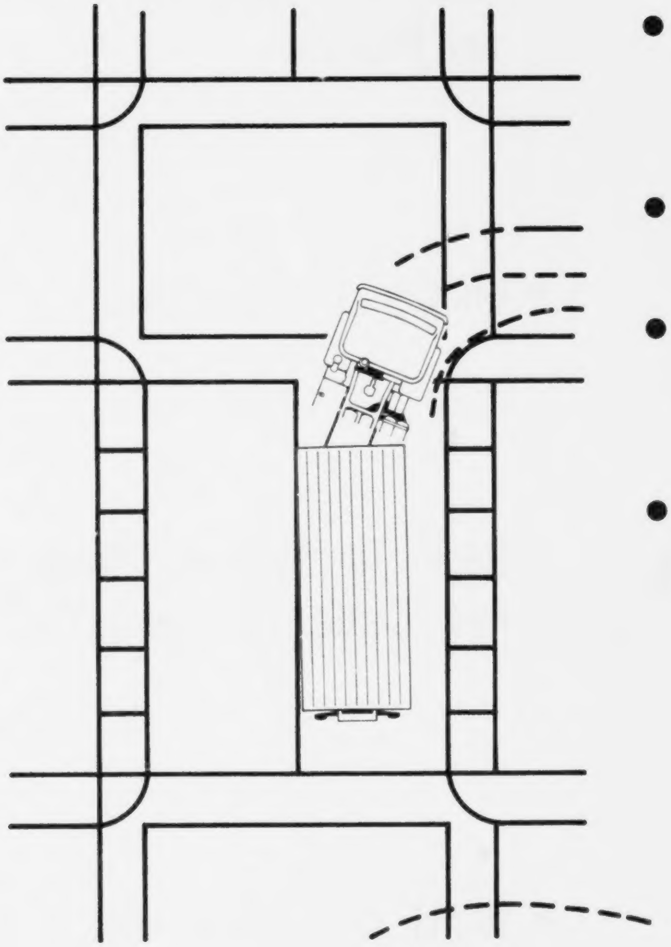
Tractor-Trailer Tracking Characteristics


Single-Unit Vehicle


Tractor Semi-Trailer

Visual 12

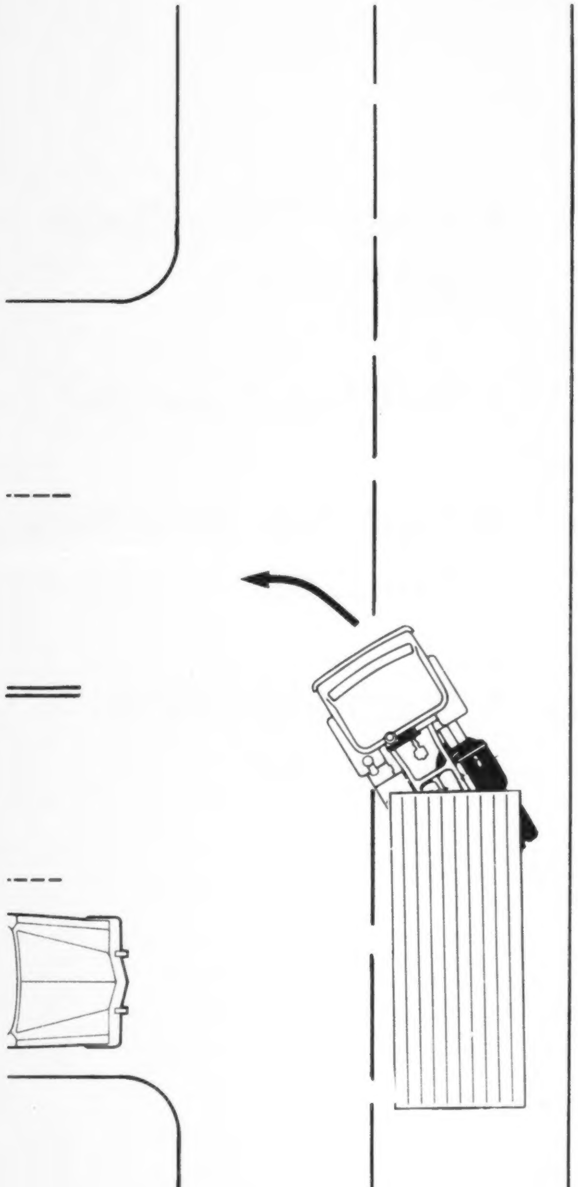
Making Right Turns



- Assume Proper Speed and Position
- Shift Into Proper Gear
- Begin Turn When Halfway Past Corner
- Watch Right Mirror During Turn

Visual 13

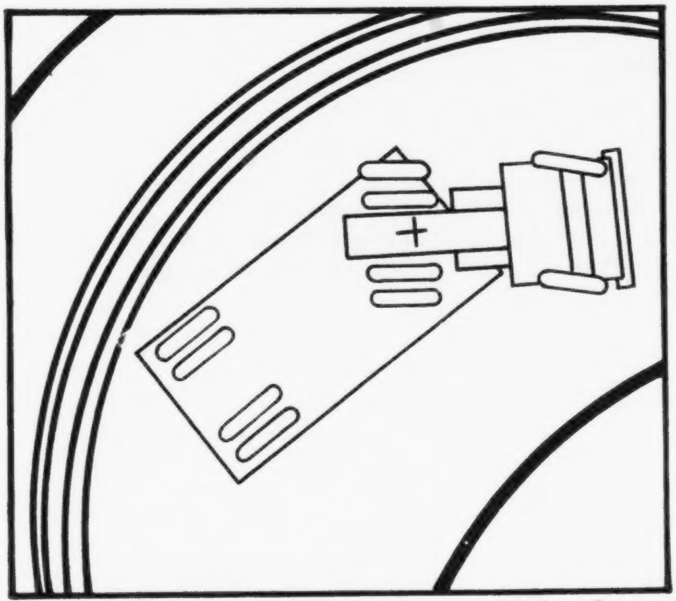
Making a Left Turn



- Assume Proper Speed and Position
- Shift Into Proper Gear
- Begin Turn When Halfway Past Center of Intersection
- Watch Left Mirror During Turn

Visual 14

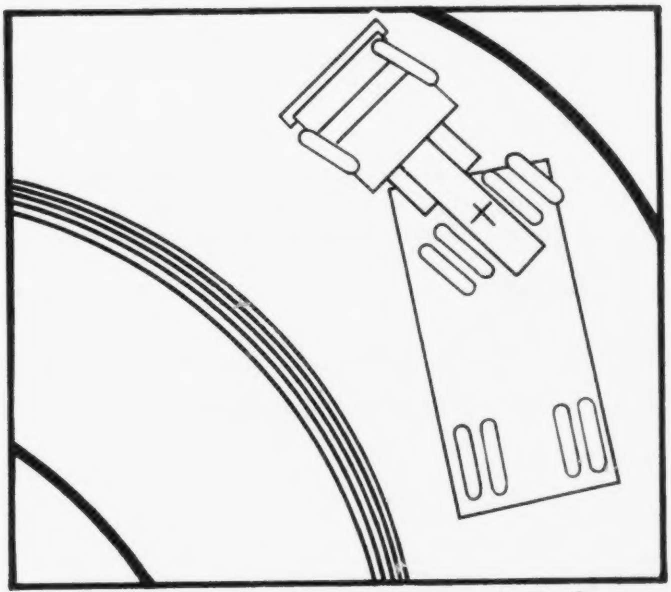
Right and Left Highway Curves



Proper Execution for Taking a Right Curve

- Right Curves–
  Keep Tractor
  Towards the
  Center of Road

- Left Curve–
  Keep Tractor
  Towards the
  Outside of Curve



Proper Execution for Taking a Left Curve

LESSON 2. STARTING AND TURNING OFF THE ENGINE (Range)

Overview

Time Allotted: 35 minutes

Prerequisites: Unit 1.4, Lesson 1

Purpose:

The purpose of this lesson is to develop student ability to properly start up and shutdown a diesel engine. After an instructor demonstration each student will practice starting and turning off an engine. The instructor will monitor student practice and critique performance.

Materials

Instructional Aids

None

Student Material

Checklists for starting two-and four-cycle diesel engines, in Unit 1.4 of Student Manual

Instructor Material

No additional material required

Equipment

An unladen tractor-trailer. The tractor should be coupled to trailer, carefully inspected and warmed up prior to this lesson. This will insure proper demonstration and student practice.

Content

Activity or Topic	Approximate Time
1. DEMONSTRATION AND PRACTICE	35 minutes

1. DEMONSTRATION AND PRACTICE (35 minutes)

Purpose

The purpose is to demonstrate and practice starting, warming and shutting down an engine.

Range Layout

No specific layout is required.

Directions

1. Divide students into groups of three. Assign each group to one instructor/vehicle.
2. Instructor will demonstrate the start up techniques using procedures outlined in classroom activity and based on manufacturers instructions (5 minutes).
3. Verbal explanation of technique should be given simultaneously. Students may also refer to their checklists.
4. In explaining warmup procedures, the instructor should emphasize the importance of proper gauge readings required for operation.
5. The instructor will demonstrate shutdown procedures, giving an explanation of procedures and techniques.
6. Each student, in turn, progresses through the start up, warmup and shutdown procedures (10 minutes per student).
7. An instructor must be in cab with each student during practice sessions to correct the student's errors in procedures as they occur.

Observation

The instructor will observe for failure to perform the following procedures properly:

Starting Engine (See manufacturer's instructions also)

Apply parking brakes
Disengage clutch and move gearshift to neutral
Open manual fuel valve
Turn switch key to start position
Disengage clutch until engine is running
Depress starter button, engaging starter
Observe engine oil pressure and temperature gauges
Engage clutch at idling rpm
Check other instruments and gauges

Turning Off the Engine (See vehicle manufacturer's instructions also)

Place transmission in neutral
Turn wheels to the proper position and set parking brake
Allow engine to idle
Check fuel valve
Turn switch-key to the "off" position.

Evaluation

Student performance will be evaluated against the compliance with prescribed procedures.

LESSON 3 PUTTING THE VEHICLE IN MOTION (Range)

Overview

Time Allotted: 1 hour 40 minutes

Prerequisites: Unit 1.4, Lesson 2

Purpose:

The purpose of this lesson is to develop student ability to safely put a tractor-trailer in motion, test the tractor-trailer hookup, go forward, then back up in a straight line and stop. An instructor will demonstrate proper techniques, followed by student practice.

Materials

Instructional Aids

None

Student Material

Checklist for testing trailer hookup, stopping the tractor-trailer and backing the tractor-trailer in a straight line, in Unit 1.4 of the Student Manual

Instructor Material

Range diagram for Exercise 1 (at end of lesson)

Equipment

Tractor-trailer. Test the coupling prior to instructor demonstration and student practice

Rubber traffic cones - 8 required per vehicle

Content

Activity or Topic	Approximate Time
1. PUTTING THE VEHICLE IN MOTION	1 hour 40 minutes

1. PUTTING THE VEHICLE IN MOTION (1 hour 40 minutes)

Purpose

The purpose of this lesson is to provide students with practice in putting the vehicle in motion.

Range Layout

See Range Diagram, Exercise 1.

Directions

1. All vehicle couplings tested prior to this lesson
2. Range setup (e.g., vehicles in place, stanchions set); see range layout diagrams
3. Instructor explains and demonstrates exercise
    - Put vehicle in motion, test hookup
    - Travel approximately 1/3 of the exercise (100') and stop
    - Begin motion again, travel another 1/3 of the exercise (100') and stop
    - Begin motion again, travel the remaining 1/3 of the exercise (100') and stop even with the two exercise stanchions
    - Back vehicle in straight line to original starting point
4. Divide students into groups of three. Assign each group to one instructor/vehicle
    - Students review their checklists
    - Students move vehicle forward

        Student puts vehicle in motion, tests hookup

        Travels approximately 1/3 of the distance (100') to the end of exercise point and stops

        Puts vehicle in motion again, stops after traveling another 1/3 of the exercise lane

        Again puts vehicle in motion, travels to the end of the exercise (designated by stanchions) and stops

    - Students back in straight line

        Puts vehicle in reverse

        Backs in straight line to end of exercise point

5. Instructor remains in the cab during exercise to give instruction and assistance.

Observation

The instructor will observe for failure to perform the following procedures.

Putting the Vehicle in Motion

Depress clutch, place transmission in lowest forward gear
Gradually release clutch to friction point
Gradually depress throttle pedal to move load
When vehicle is in motion with clutch fully engaged, take left foot off clutch until ready to shift again or stop

NOTE: Students should be taught to release clutch and depress throttle in sequence--rather than simultaneously.

Testing Tractor-Trailer Hookup

- Vehicles equipped with hand valve
  - Depress clutch, move gearshift to lowest forward gear
  - Engage hand valve lever applying trailer brakes
  - Release clutch to friction point
  - Pull gently forward against locked trailer brakes
  - Disengage clutch
  - Repeat procedure
- Vehicles without trailer hand valve
  - Depress clutch, move gearshift to lowest forward gear
  - Switch tractor protection valve to "emergency"
  - Partially engage clutch and pull gently against brake
  - Repeat procedure

Stopping the Tractor-Trailer

Release accelerator pedal
Depress brake pedal for maximum valve opening
As the vehicle begins to slow, decrease brake pedal pressure
Stop vehicle smoothly by releasing brake pressure in relation to vehicle deceleration (stopping) rate
As vehicle halts, release pedal completely
Disengage clutch as vehicle halts
After halting, place gearshift lever in neutral and reapply brake just enough to keep vehicle stationary

Backing in a Straight Line

- Position vehicle properly
  - Put in position by moving forward
  - Wheels and vehicle straight

- Speed
  - Put vehicle in reverse
  - Back as slowly as possible (use idle engine speed)
  - Don't ride clutch or brake
  - Constantly check behind when backing

Steering

- Keep vehicle within 25-foot lane
- Do not oversteer
- Correcting drifts
  - Turn steering wheel in direction of drift as soon as it ocurs
  - Do not oversteer, only slight movement required if caught right away
  - Little drifts need little correction; big drifts need big ones
- Use "push-pull" method of steering to keep trailer in line
  - When trailer image gets bigger in mirror, push steering wheel towards mirror, i.e., towards left (if left mirror)
  - Immediately pull steering wheel back in order to straighten steering wheel
  - If late in catching larger image of trailer, push wheel more
- Pull up and start again if too far out of position

Instructor should watch for the following common problems:

1. Students who are having difficulty backing in a straight line. Two errors need attention.

2. Students not recognizing drifting and failure to make correction in time. Students needs to be reinstructed on use of mirrors to recognize when vehicle is getting out of line, i.e., trailer image begins to appear larger in one mirror than the other.

3. Students unable to correct drifting by steering. If the student is having difficulty getting used to steering backwards, there is probably a need to reinstruct him on the push-pull method of steering.

Evaluation

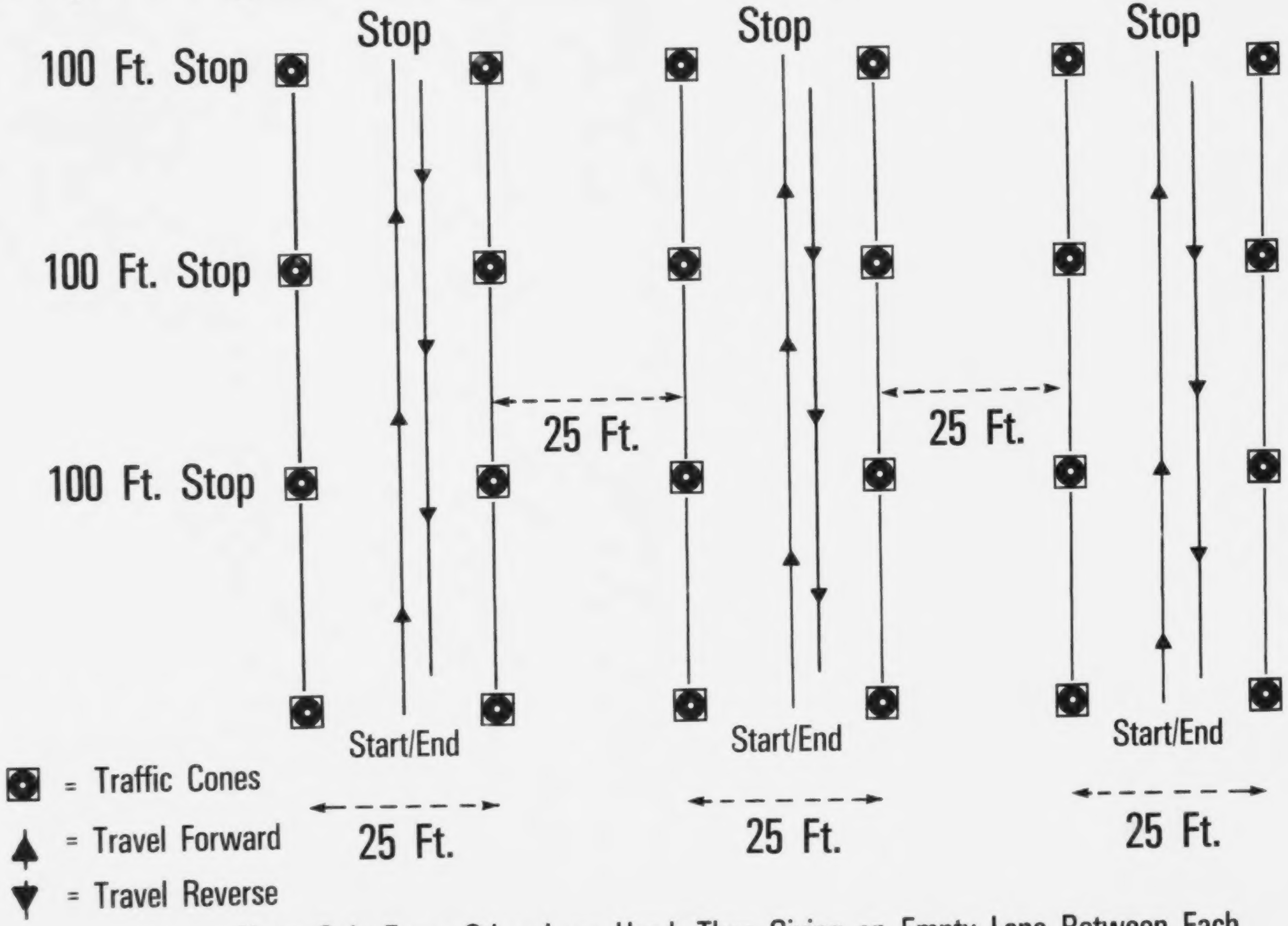
Student performance will be evaluated against the following criteria:

1. Puts vehicle in motion smoothly (no lugging, stalling, or over revving).

2. Stops smoothly (no stalling, jerking, nose rebound, sound of vented air).

3. Backs in straight line properly with decreasing need to correct trailer drift.

Range Diagram—Exercise 1 (Putting the Vehicle in Motion)


Stop
Stop
Stop
100 Ft. Stop
100 Ft. Stop
100 Ft. Stop
25 Ft.
25 Ft.
Start/End
Start/End
Start/End
25 Ft.
25 Ft.
25 Ft.
= Traffic Cones
= Travel Forward
= Travel Reverse

Note: Only Every Other Lane Used, Thus Giving an Empty Lane Between Each Vehicle for a Safety Margin

LESSON 4 TURNING THE TRACTOR-TRAILER (RANGE)

Overview

Time Allotted: 5 hours

Prerequisites: Unit 1.4, Lesson 3

Purpose:

The purpose of this lesson is to develop student ability to turn the tractor-trailer. Seven different exercises will be used to provide practice for student drivers. An instructor demonstration of each exercise will be used, followed by individual student practice monitored by the instructor.

Materials

Instructional Aids

None

Student Material

Range Safety Rules, in Unit 1.1 of Student Manual

Range Diagrams for Exercises 1 through 8, in Unit 1.4 of Student Manual

Instructor Material

Range Diagrams for Exercises 1 through 8 (at end of lesson)

Equipment

Tractor-trailer. Driving range equipment as specified in the exercise diagrams.

Content

Activity or Topic	Approximate Time
1. SERPENTINE	50 minutes
2. FIGURE 8	35 minutes
3. RESTRICTED FIGURE 8	35 minutes
4. TURNS	50 minutes
5. RESTRICTED TURNS	35 minutes
6. SHARP TURNS	50 minutes
7. COMBINATION TURNS	45 minutes
	5 hours

1. SERPENTINE (50 minutes)

Purpose

The purpose of this exercise is to give students initial practice turning a tractor-trailer over a course with gentle curves and wide dimensions.

Range Layout

See Range Diagram, Exercise 2.

Directions

1. The instructor divides the students into groups of three students for each vehicle.
2. The instructor describes and demonstrates the exercise to students (5 minutes).
3. Students perform the exercise, weaving among the markers (15 minutes per student). The approach to the first cone is alternated, right side, left side, etc.
4. Instructor remains in cab during exercise to give instruction and feedback and to regulate degree of difficulty by approach speed.
5. One student observer remains in the vehicle. The other observer stays outside to keep count of, and reset, markers that are struck.

Observation

The instructor will observe for failure to perform the following procedures properly:

Line the vehicle up before beginning each run through the serpentine course.

Maintain a speed limit that permits the course to be completed as quickly as possible with minimum sway or the need to brake in turns.

Make turns at the appropriate point to maintain the straightest possible course without knocking over the markers.

If forced to stop and back up, do so smoothly with proper braking and shifting.

Keep eyes focused on the far end of the course rather than the marker immediately in front of the vehicle.

Evaluation

Student performance will be evaluated against the following criteria:

1. Time to complete each run.
2. Number of markers struck.
3. Ability to maintain a constant speed and as straight a course as possible.

2. FIGURE 8 (35 minutes)

Purpose

The purpose of this exercise is to give students an opportunity to practice driving the tractor-trailer in a restricted area with more difficult curves than in previous exercise.

Range Layout

See Range Diagram, Exercise 3.

Directions

1. The instructor divides the students into groups of three students for each vehicle.
2. The instructor describes and demonstrates the exercise to students (5 minutes).
3. Students perform the exercise as diagrammed two times then reverse direction. Each student drives for 10 minutes, alternating direction after each trial.
4. Instructor remains in cab during exercise to give instruction and feedback and to regulate degree of difficulty by approach speed.
5. One student observer remains in the vehicle. The other observer stays outside to keep count of, and reset, markers that are struck.

Observation

The instructor will observe for failure to perform the following procedures correctly:

Make smooth, constant radius turns at each end of the Figure 8

Begin each turn at the appropriate point to permit a constant radius turn

Operates at a speed that allows the exercise to be completed as quickly as possible without excessive vehicle sway.

Keep eyes focused upon the next marker rather than the one being negotiated.

Make each change of direction in a smooth, continuous motion.

Evaluation

Student's performance will be evaluated against the following criteria:

1. Time to complete each pair of runs through the exercise layout.
2. Number of steering corrections, (beyond the two that are required to change direction during each turn).
3. Number of speed changes made (acceleration, braking).

3. RESTRICTED FIGURE 8 (35 minutes)

Purpose

The purpose of this exercise is to give students practice using the Figure 8, but introducing sharper turns to finish the exercise.

Range Layout

See Range Diagram, Exercise 4.

Directions

1. The instructor divides the students into groups of three students for each vehicle.
2. The instructor describes and demonstrates the exercise to students (5 minutes).
3. Students perform the exercise as diagrammed two times then reverse direction. Each student drives for 10 minutes, alternating direction after each trial.
4. Instructor remains in cab during exercise to give instruction and feedback and to regulate degree of difficulty by approach speed.
5. The observer remains in the vehicle. The other observer stays outside to keep count of, and reset, markers that are struck.

Observation

Same as for the figure 8 exercise

Evaluation

Students performance will be evaluated against the following criteria:

1. Time to complete each pair of runs through the exercise layout.
2. Number of steering corrections, (beyond the two that are required to change direction during each turn).
3. Number of speed changes made (acceleration, braking).

4. TURNS (50 minutes)

Purpose

The purpose of this exercise is to give students initial practice judging speeds for and carrying out right and left hand turns.

Range Layout

See Range Diagram, Exercise 5.

Directions

1. The instructor divides the students into groups of three students for each vehicle.
2. The instructor describes and demonstrates the exercise to students (5 minutes).
3. Students perform the exercise as diagrammed two times, then reverses direction. Each student drives for 15 minutes, alternating direction after each trial.
4. Instructor remains in cab during exercise to give instruction and feedback and to regulate degree of difficulty by approach speed.
5. One student observer remains in the vehicle. The other observer stays outside to keep count of, and reset, markers that are struck.

Observation

The instructor will observe for failure to perform the following procedures correctly:

> Accelerate on a straightaway between each set of markers, and brake smoothly to the maximum safe speed for entry into the turn at the end of the straightaway.
>
> Avoid having to brake during the turns.

Focus eyes on the point at which each turn is to be completed (beginning of straightaway) rather than upon the marker directly in front of the vehicle.

Avoid striking markers in turns pulling into and coming out of each set of cones.

Evaluation

Student's performance will be evaluated against the following criteria:

1. Time to complete each pair of runs through the exercise layout.
2. Number of steering corrections, (beyond the two that are required to change direction during each turn).
3. Number of speed changes made (acceleration, braking).

5. RESTRICTED TURNS (35 minutes)

Purpose

The purpose of this exercise is to increase student proficiency in turning by introducing higher speeds and narrower dimensions than in Exercise 4.

Layout

See Range Diagram, Exercise 6.

Directions

1. The instructor divides the students into groups of three students for each vehicle.
2. The instructor describes and demonstrates the exercise to students (5 minutes).
3. Students perform the exercise as diagrammed two times then reverses direction. Each student drives for 10 minutes, alternating direction after each trial.
4. Instructor remains in cab during exercise to give instruction and feedback and to regulate degree of difficulty by approach speed.
5. The observer remains in the vehicle. The other observer stays outside to keep count of, and reset, markers that are struck.

Observation

The instructor will observe for failure to perform the following procedures correctly.

Make smooth, constant radius turns at each end of the Figure 8.

Begin each turn at the appropriate point to permit a constant radius turn.

Operates at a speed that allows the exercise to be completed as quickly as possible without excessive vehicle sway.

Keep eyes focused upon the next marker rather than the one being negotiated.

Make each change of direction in a smooth, continuous motion.

Evaluation

Student's performance will be evaluated against the following criteria:

1. Time to complete each pair of runs through the exercise layout.
2. Number of steering corrections, (beyond the two that are required to change direction during each turn).
3. Number of speed changes made (acceleration, braking).

6. SHARP TURNS (50 minutes)

Purpose

The purpose of this exercise is to increase student proficiency by requiring sharper turns in a restricted area.

Layout

See Range Diagram, Exercise 7.

Directions

1. The instructor divides the students into groups of three students for each vehicle.
2. The instructor describes and demonstrates the exercise to students (5 minutes).
3. Students perform the exercise as diagrammed two times, then reverses direction. Each student drives for 15 minutes, alternating direction after each trial.

4. Instructor remains in cab during exercise to give instruction and feedback and to regulate degree of difficulty by approach speed.

5. The observer remains in the vehicle. The other observer stays outside to keep count of, and reset, markers that are struck.

Observation

The instructor will observe for failure to perform the following procedures correctly:

Accelerate on a straightaway between each set of markers, and brake smoothly to the maximum safe speed for entry into the turn at the end of the straightaway.

Avoid having to brake during the turns.

Focus eyes on the point at which each turn is to be completed (beginning of straightaway), rather than upon the marker directly in front of the vehicle.

Avoid striking markers in turns pulling into and coming out of each set of cones.

Evaluation

Student's performance will be evaluated against the following criteria:

1. Time to complete each pair of runs through the exercise layout.
2. Number of steering corrections, (beyond the two that are required to change direction during each turn).
3. Number of speed changes made (acceleration, braking).

7. COMBINATION TURNS (45 minutes)

Purpose

This exercise provides students an opportunity to practice a combination of curves and turns from the first six exercises.

Range Layout

See Range Diagram, Exercise 8.

Directions

1. The instructor divides the students into groups of three students for each vehicle.

2. The instructor describes and demonstrates the exercise to students (5 minutes).

3. Students perform the exercise as diagrammed two times, then reverse direction. Each student drives for 10 minutes, alternating direction after each trial.

4. Instructor remains in cab during exercise to give instruction and feedback and to regulate degree of difficulty by approach speed.

5. The observer remains in the vehicle. The other observer stays outside to keep count of, and reset, markers that are struck.

Observation

The instructor will observe for failure to perform the following procedures correctly:

Accelerate on a straightaway between each set of markers, and brake smoothly to the maximum safe speed for entry into the turn at the end of the straightaway.

Avoid having to brake during the turns.

Focus eyes on the point at which each turn is to be completed (beginning of straightaway) rather than upon the marker directly in front of the vehicle.

Avoid striking markers in turns pulling into and coming out of each set of cones.

Evaluation

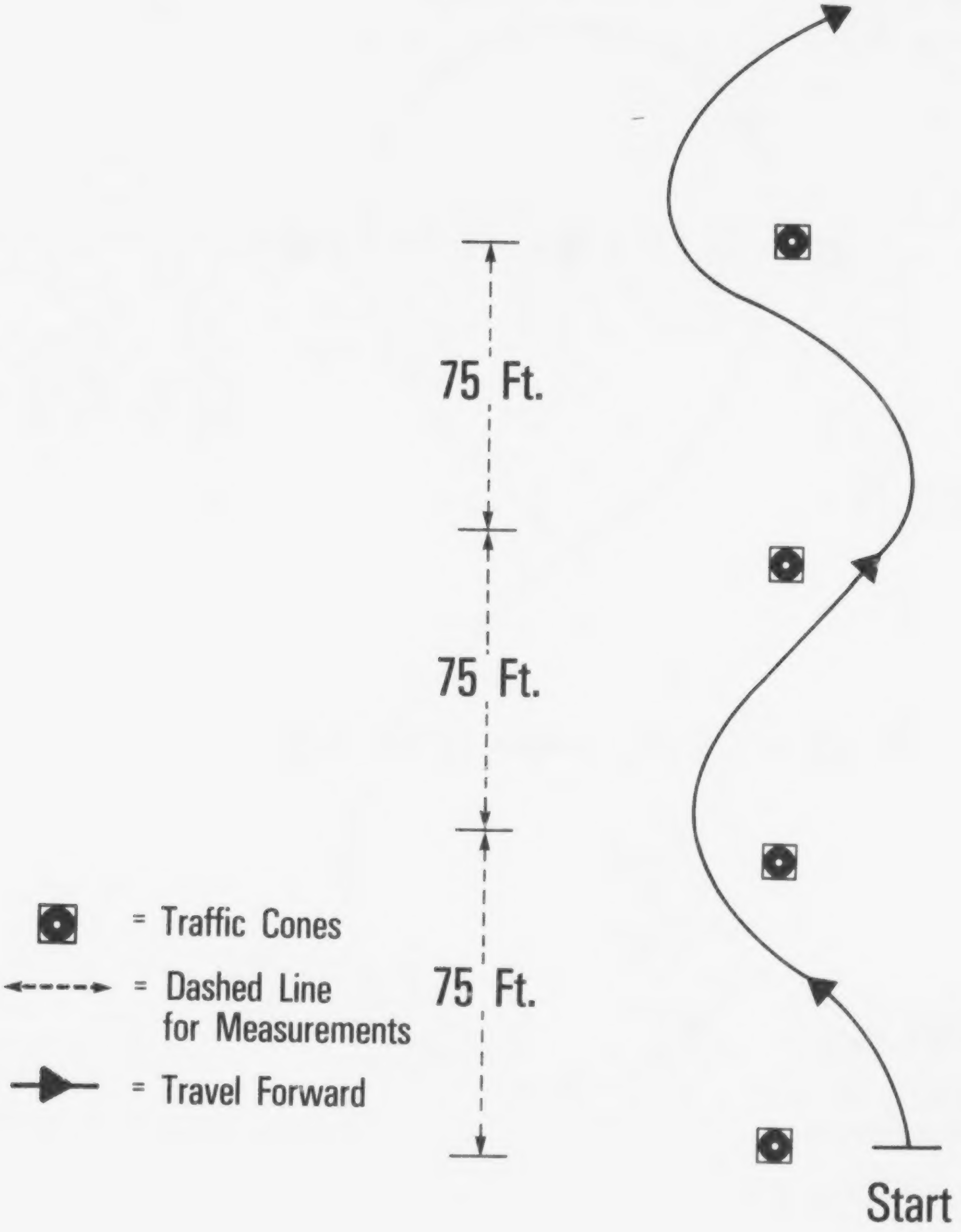
Student's performance will be evaluated against the following criteria:

1. Time to complete each pair of runs through the exercise layout.

2. Number of steering corrections, (beyond the two that are required to change direction during each turn).

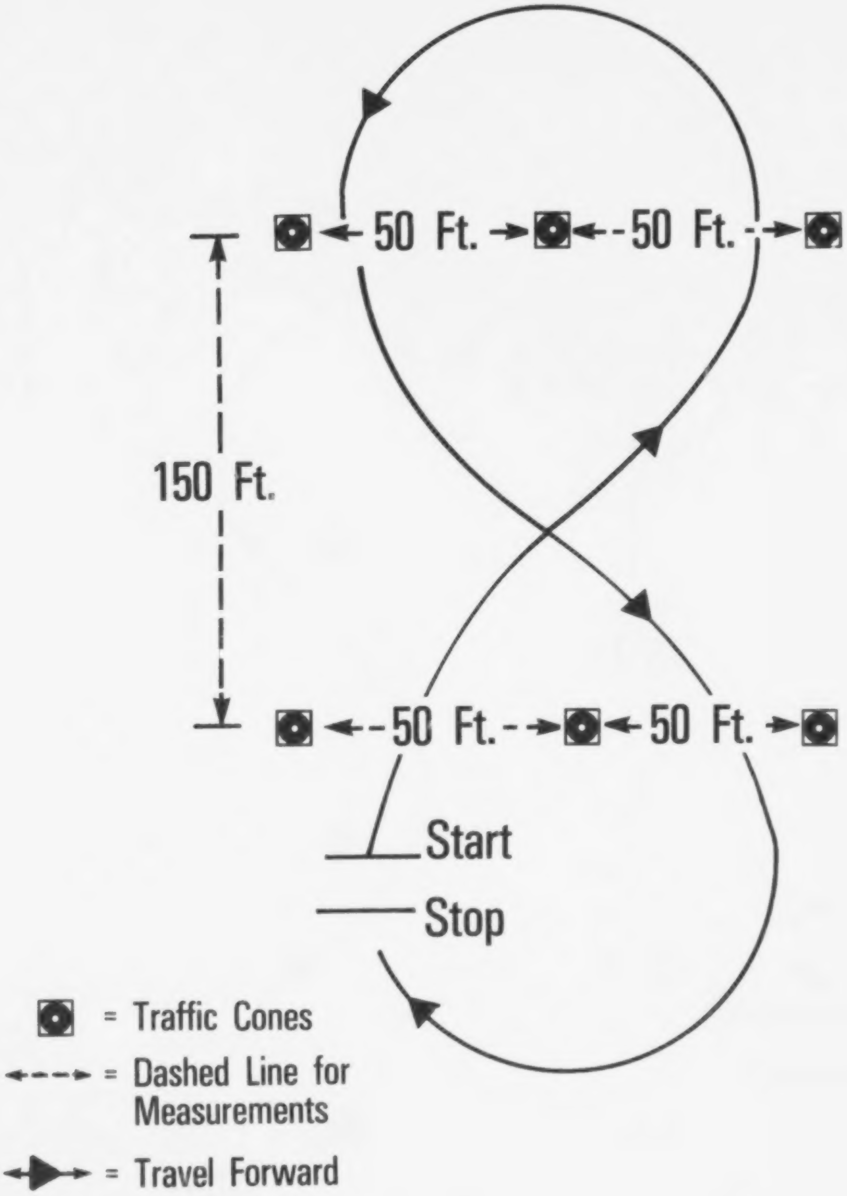
3. Number of speed changes made (acceleration, braking).

Range Diagram—Exercise 2
(Serpentine)


75 Ft.
75 Ft.
75 Ft.
= Traffic Cones
= Dashed Line for Measurements
= Travel Forward
Start

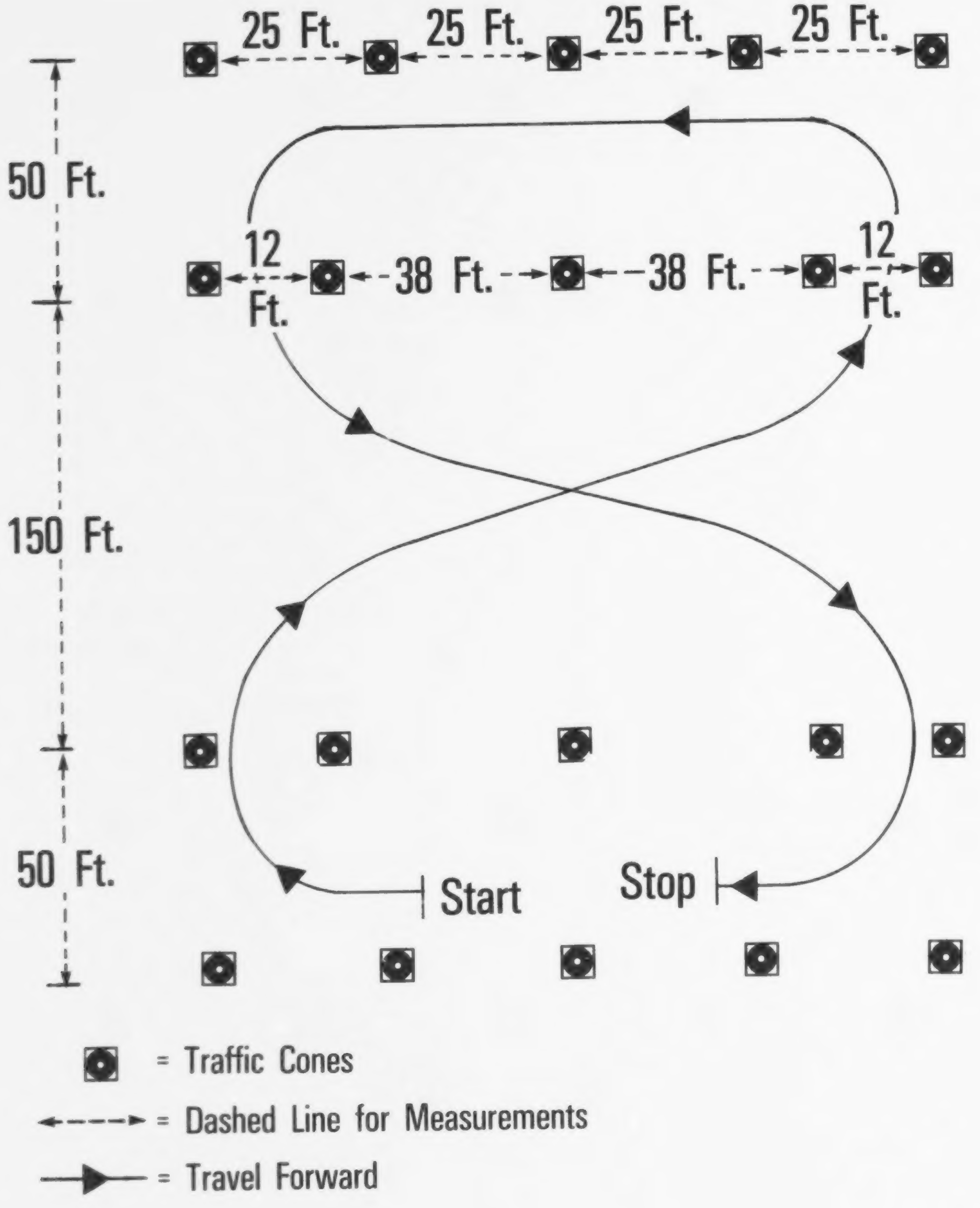
Range Diagram—Exercise 3

(Figure 8)


50 Ft.
50 Ft.
150 Ft.
50 Ft.
50 Ft.
Start
Stop
= Traffic Cones
= Dashed Line for Measurements
= Travel Forward

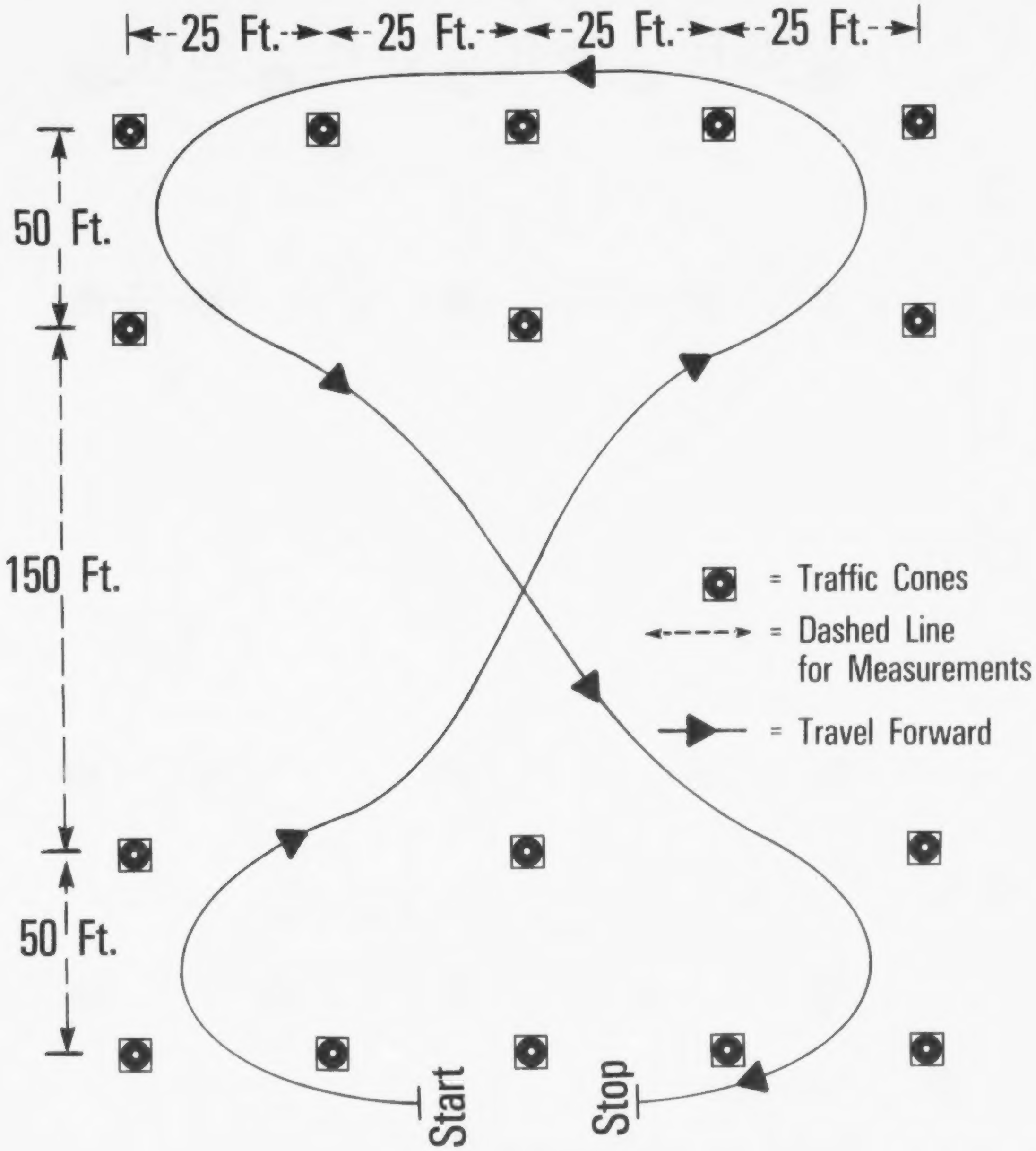
Range Diagram—Exercise 4

(Restricted Figure 8)


25 Ft.
25 Ft.
25 Ft.
25 Ft.
50 Ft.
12 Ft.
38 Ft.
38 Ft.
12 Ft.
150 Ft.
50 Ft.
Start
Stop
■ = Traffic Cones
←----→ = Dashed Line for Measurements
—▶— = Travel Forward

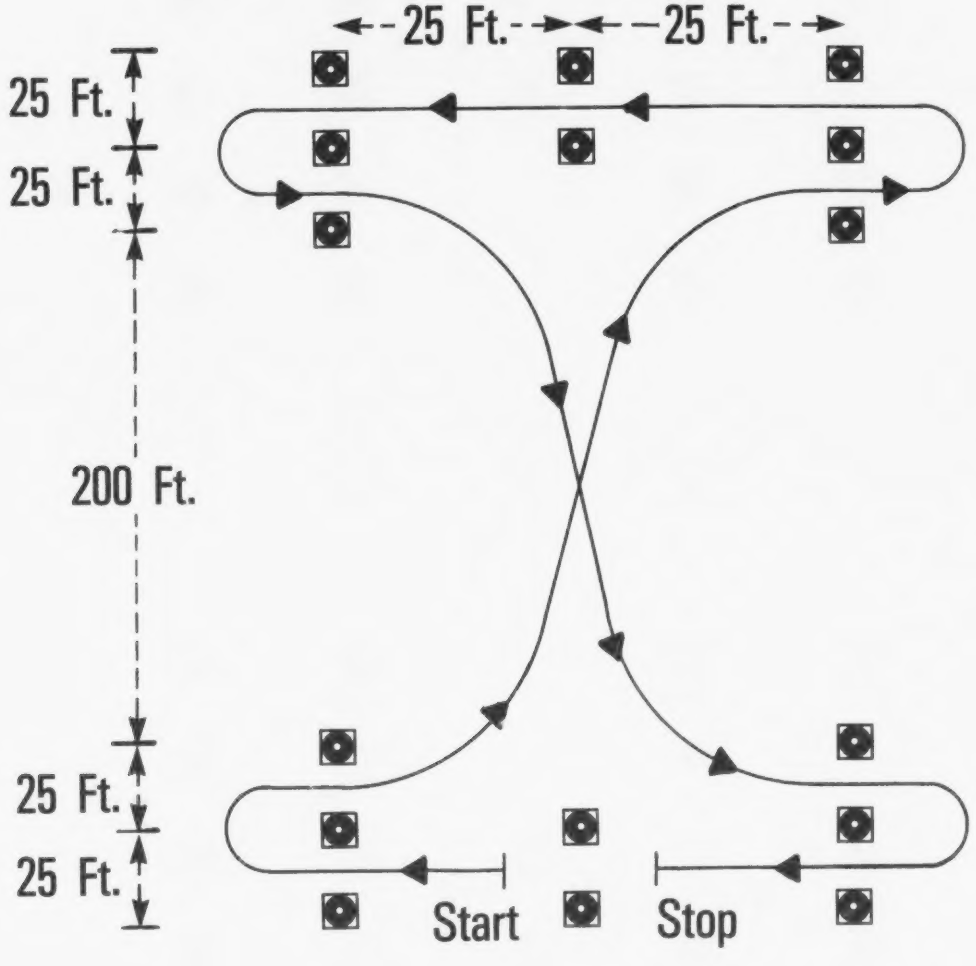
Range Diagram—Exercise 5

(Turns)


25 Ft.
25 Ft.
25 Ft.
25 Ft.
50 Ft.
150 Ft.
50 Ft.
Start
Stop
= Traffic Cones
= Dashed Line for Measurements
= Travel Forward

Range Diagram—Exercise 6

(Restricted Turns)


25 Ft.
25 Ft.
25 Ft.
25 Ft.
200 Ft.
25 Ft.
25 Ft.
Start
Stop

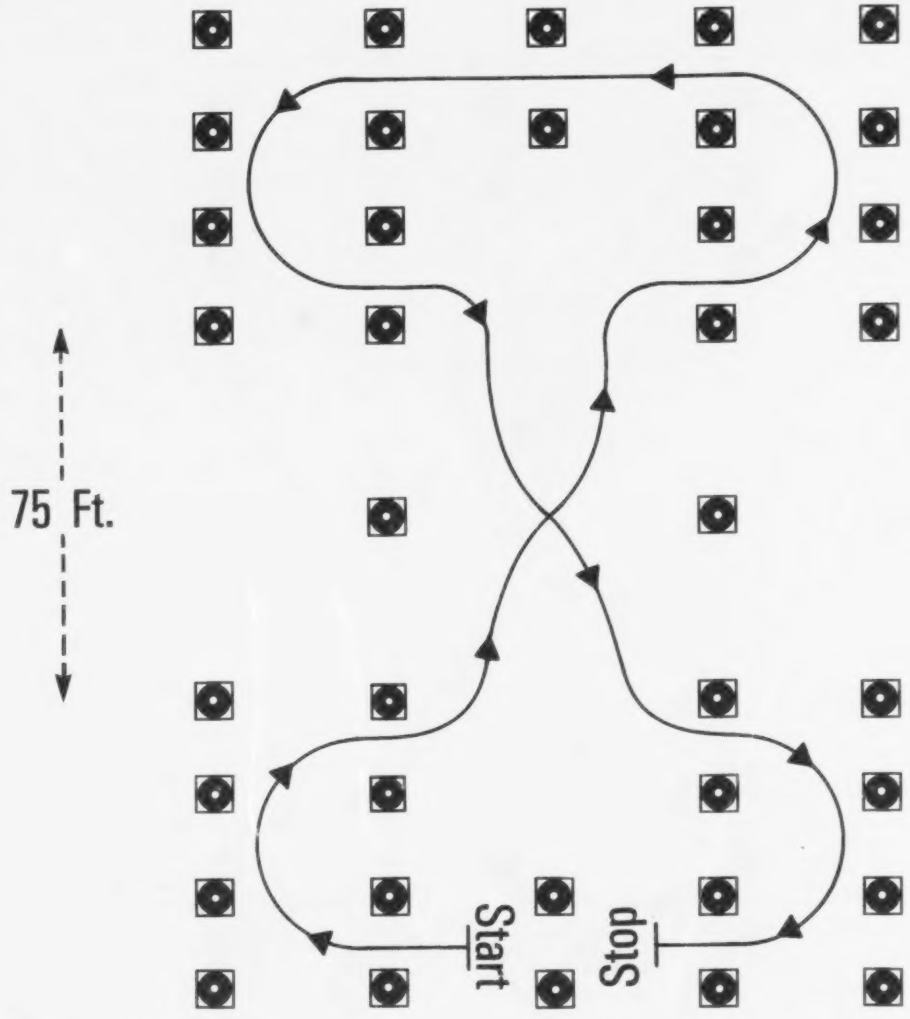
◘ = Traffic Cones

←---→ = Dashed Line for Measurements

—▶— = Travel Forward

Range Diagram—Exercise 7

(Sharp Turns)


75 Ft.
Start
Stop

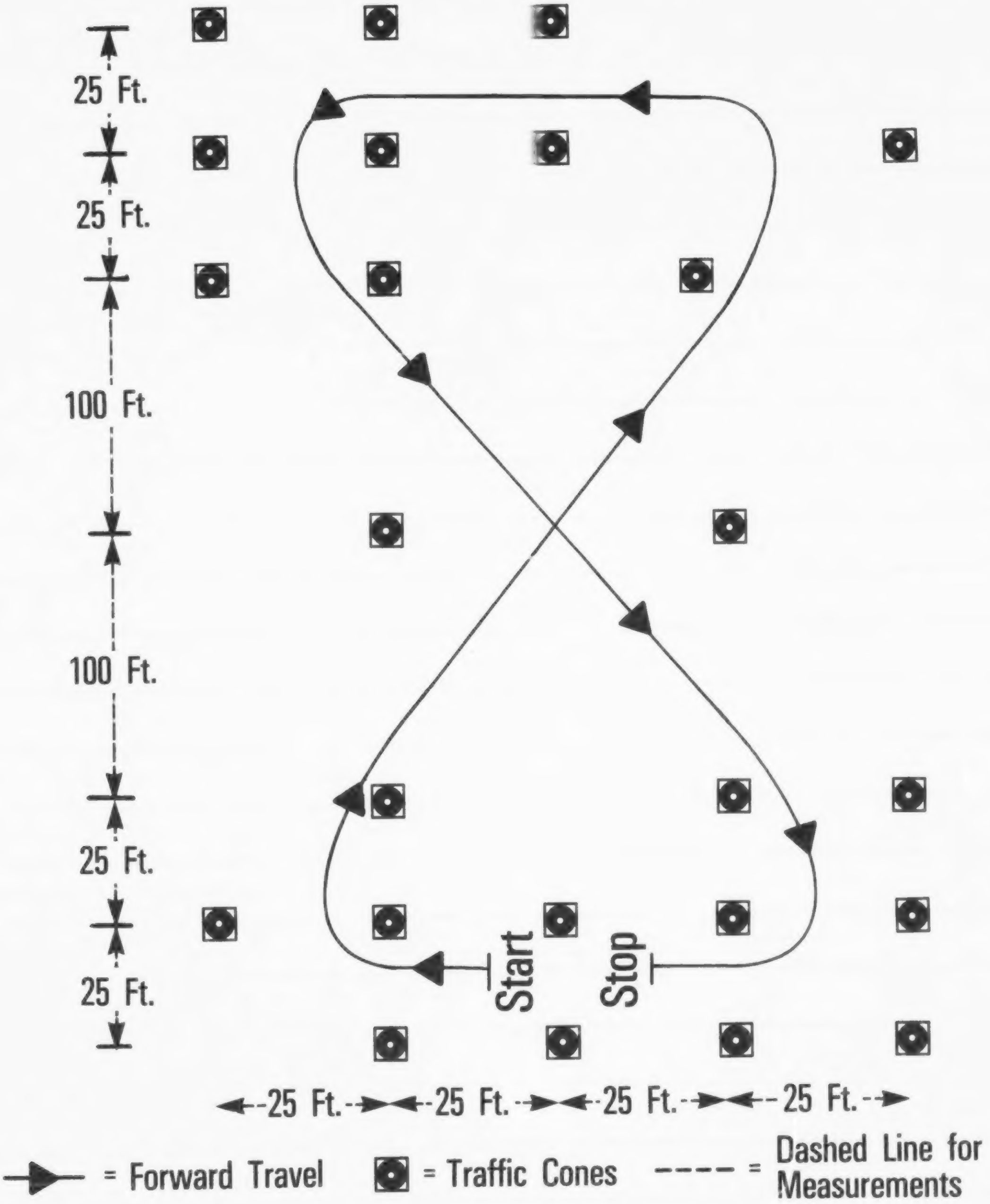
◙ = Traffic Cones

←- - - -→ = Dashed Line for Measurements

─▶─ = Travel Forward

Range Diagram—Exercise 8

(Combination Turns)


25 Ft.
25 Ft.
100 Ft.
100 Ft.
25 Ft.
25 Ft.
Start
Stop
25 Ft.
25 Ft.
25 Ft.
25 Ft.
= Forward Travel
= Traffic Cones
---- = Dashed Line for Measurements

Notes:

UNIT 1.5
SHIFTING

UNIT 1.5 SHIFTING

PURPOSE

The purpose of this unit is to introduce shifting patterns and procedures to the students so they can efficiently perform basic gear shifting maneuvers.

OBJECTIVES

Performance Objectives

Students must be able to

- shift up and down through all gears of all major types of conventional transmissions, including auxiliary transmissions and multi-speed axles.
- double clutch and time your shift for smooth and fuel-efficient performance.
- select proper gear for speed and highway conditions.
- operate a fully automatic and semi-automatic transmissions.

Knowledge Objective

Students must know

- shifting procedures for transmissions.
- the instruments and controls necessary to shift gears properly.
- the shift patterns of all major types of conventional transmissions.
- common shifting errors and their consequences.

Skill Objective

Students must be able to coordinate use of hands, feet, sight, and hearing in shifting, including double clutching, to achieve maximum performance consistent with economy, safety and smoothness of operation.

Attitude Objectives

Students must believe that

- improper use of clutch and transmission will cause severe damage to the vehicle.
- using proper shifting techniques will improve fuel mileage, reduce operating costs, and benefit the company and the driver.

LESSONS

Lesson 1.	Shifting Procedures (Classroom)	1 hour 15 minute
Lesson 2.	Development of Shifting Skills (Range)	3 hours

LESSON 1 SHIFTING PROCEDURES (CLASSROOM)

Overview

Time Allotted: 1 hour 15 minutes

Prerequisites: Unit 1.4

Purpose:

The purpose of this lesson is to present the basic concepts related to shifting and examples of the most common shifting patterns and procedures. It is also preparation for the range exercises which follow.

Materials

Instructional Aids

Visuals 1 - 10

Student Material

Double Clutching Technique, in Unit 1.5 of Student Manual
Controls and Shift Patterns for Spicer 4 x 3, 10-speed, Road Ranger 13-speed Road Ranger and for a 2-speed rear axle, in Unit 1.5 of Student Manual

Instructor Material

Transmission shifting information (patterns and procedures) reproduced from Operator Manuals for the tractors that will be used in the range lesson for this unit.

Content

Activity or Topic	Approximate Time
1. KEY ELEMENTS OF SHIFTING	15 minutes
2. SHIFTING PATTERNS AND PROCEDURES	40 minutes
3. SHIFTING AUTOMATIC AND SEMI-AUTOMATIC TRANSMISSIONS	10 minutes
4. CONSEQUENCES OF IMPROPER SHIFTING	5 minutes
5. SUMMARY AND RANGE PREPARATION	5 minutes
	1 hour 15 minutes

1. KEY ELEMENTS OF SHIFTING (15 minutes)

Visual 1 Key Elements of Shifting

Shifting Gears

Proper shifting involves knowledge and skill
- Knowledge taught in this lesson
- Skill developed through range exercises

Knowledge involved in and understanding of

- Shift controls
- When to shift
- How to shift, i.e., double clutching

Visual 1 Key Elements of Shifting

Shifting Controls

(Refer to illustration at left of Visual)

Accelerator (top of illustration)

- Controls flow of fuel to engine
- Determines speed of the engine in any one gear

Shift Lever (bottom of illustration)

- Controls what gear the transmission is in
- Gear that is selected determines the amount of road speed and power supplied by the engine in any one accelerator position
- Low gear
  - A lot of power
  - Little road speed
  - Supplies the power needed to build up momentum
- High gear
  - A lot of road speed
  - Little power
  - Allows vehicle to obtain high road speed once momentum is developed
- Relationship among gear, power, and road speed will be described during discussion of transmissions in Unit 4.1, Vehicle Systems

Clutch (middle of illustration)

- Controls connection between engine and transmission
- Determines whether transmission can be safely shifted
- Clutch pedal down
  - Engine and transmission are disengaged
  - Gears may be safely shifted
- Clutch pedal up
  - Engine and transmission are engaged
  - Gears cannot be safely shifted

Coordination of Controls

- Operation of controls requires coordination, i.e., precise timing
- Lack of coordination can cause:
  - Over revving
    - Engine speeds up before transmission is engaged
    - Results from lack of coordination between accelerator and clutch pedal
  - Clash of gears
    - Shifting into a gear while the transmission and engine are still engaged
    - Results from lack of coordination between clutch pedal and shift lever

When to Shift

Upshifting

- Objective
  - Shift as soon as the vehicle's speed and momentum allows power to be reduced and speed to be increased
  - Consequences of shifting at the wrong time
    - Shifting too early
      - Vehicle does not have enough momentum
      - Engine cannot supply enough power
      - Engine "lugs"
        - Puts strain on engine parts
        - Speed begins to drop
    - Shifting too late
      - Engine is supplying more power than is needed
      - Causes engine to overspeed, i.e., "over rev"
        - Wastes fuel
        - Not enough speed is generated
    - Similar to shifting a 10-speed bicycle
      - Shifting too early
        - Not enough momentum
        - Legs can't supply enough power
        - Have to pump hard
        - Places strain on bicycle rider
    - Shifting too late
      - Legs supply more power than is necessary
      - Pedals turn very fast
        - Wastes the rider's energy
        - Bicycle doesn't build up speed

Downshifting

- Objective--To shift as soon as momentum and road speed drop enough to match speed and power of engine

Downshifting

- Shifting too early
    - Vehicle has too much momentum for engine
    - Causes engine to over rev
        - Can cause vehicle to slow abruptly
        - Puts strain on engine parts
    - May not be able to complete the shift
    - If it becomes necessary to accelerate, engine cannot provide enough speed

Aids to Shifting

Speedometer

- There is a road speed range corresponding to every gear
    - Upshift when road speed reaches top of speed range
    - Downshift when road speed reaches bottom of speed range
- Driver must learn the speed range corresponding to each gear
    - Varies for different vehicles and transmissions
    - Driver must learn the speed range for the vehicle being driven

Tachometer

- Measures engine speed in revolutions-per-minute (rpm)
- There is a generally a single rpm range for all gears
    - Upshift when engine speed reaches the top of the recommended rpm operating range
    - Downshift when engine reaches the bottom of the recommended rpm operating range

Governor

- A device that prevents engine from over revving during upshifting
- Automatically reduces fuel to engine when maximum rpm is reached

Clutch Brake

- Stops rotation of gears
- Engaged by pushing clutch pedal all the way to the floor
- Used to engage first and reverse gears without clashing

Double Clutching

Always necesssary to double clutch when shifting a nonsynchronized transmission

Technique

- Upshifting
    - Release accelerator
    - Depress clutch
    - Move gearshift to neutral position
    - Release clutch
    - Depress clutch
    - Move gearshift to next higher gear
    - Release clutch
    - Accelerate

Downshifting
- Release accelerator
- Depress clutch
- Move gearshift to neutral position
- Release clutch
- Accelerate engine enough to match rpm with road speed to avoid clashing gears
- Depress clutch
- Maintain engine speed
- Shift into next lower gear
- Release clutch

Recap

Good shifting techniques sign of professional driver
Shifting not a measure of driver's strength, endurance
Long regarded as measure of "real driver"

Trademark of a Professional Driver's Shifting Techniques

- Good timing and coordination
- Always knows what gear he is in at any given time
- Knows top mph and rpm for each gear in his rig
- Makes all shifts without forcing/raking/grinding gears
- Never rides clutch pedal
- Always uses the clutch to make shifts
- Always selects proper gear to cruise in that achieves maximum fuel economy
- Anticipates changes in terrain and/or traffic

2. SHIFTING PATTERNS AND PROCEDURES (35 minutes)

Visual 2 Controls and Shift Patterns: Clark Five Speed

Clark Five Speed

Single manual transmissions (one gear box, one gearshift lever)

Controls

- Clutch
- Gearshift lever

Shift pattern

- Five-speed gear box
- First through fifth

Shifting procedures

- Use basic double clutching procedures for upshifting and downshifting

Visual 3 Controls and Shift Patterns: Spicer 4X3

Spicer 4X3

Two manual transmissions working together to produce 12 forward speeds (two gear boxes, two gearshift levers)

Two Transmissions

Four speed main gear box
Three speed auxiliary box

Controls

Clutch
Two gearshift levers--one for each gear box

Shift Pattern

Four gears (in the main box) are split or divided by use of the auxiliary transmission underdrive (UD), direct drive (DD) and overdrive (OD), e.g., 1st underdrive, 1st direct drive, 1st overdrive, 2nd underdrive, etc.
Known as "split shifting"

Shifting Procedures

- Upshifting
  - Depress clutch
  - Move main lever to first
  - Move auxiliary lever to UD

- Shifting from UD through OD
  - Accelerate till rpm and road speed allow you to move to next higher gear
  - Double clutch auxiliary gear shift lever
  - Moving lever from UD to DD
  - Repeat process from DD to OD

- Shifting to next higher gear, e.g., 1st OD, to 2nd UD
  - Accelerate till rpm and road speed allow you to move to next higher gear
  - Double clutch, moving main gear lever from 1st to 2nd
  - Double clutch, moving auxiliary gearshift lever from OD to UD

Continue shift pattern through 4th OD as shown at bottom of visual
Do not try to shift both levers at once
Never move main and auxiliary shift levers into neutral at the same time
Upshift in main box must be completed before upshift of auxiliary box

Downshifting--Shifting from OD through UD (e.g., 4th OD through 4th UD)
- Release accelerator
- Depress clutch
- Move auxiliary lever to neutral
- Release clutch
- Accelerate till rpm level and road speed allows gears to mesh easily
- Depress clutch
- Move auxiliary lever to 4th UD

Shifting to next lower gear (e.g., 4th UD to 3rd OD)
Under to over--an upshift, 4th to 3rd--a downshift
- Depress clutch while engine speed is decreasing
- Double clutch auxiliary lever, moving it to OD
- Move main lever from 4th to neutral (while clutch is still depressed)
- Release clutch
- Rev engine
- Depress clutch
- Enter 3rd gear
- Repeat procedures through lower gears

Visual 4 Controls and Shift Patterns: 10-Speed Road Ranger

10-Speed Road Ranger

A twin transmission combined with one gearshift lever
Same as
- Five-speed main transmission
- Two-speed auxiiary transmission

Controls

- Clutch
- Gearshift lever with range control button

Shift Pattern

- Five-speed front section
- Two-speed range section
- Shifting pattern used twice (first time--transmission in low range; second time--transmission in high range)
- First gear is in same position as sixth, second same as seventh, third same as eighth, etc.

Shifting Procedures

Upshifting
- Depress clutch
- Push range control button down (low)
- Move gear shift lever to first

        - Accelerate until rpm and road speed allow you to move to next higher gear
        - Double clutch
        - Move lever to second gear
        - Repeat procedure through fifth gear
        - When shifting from fifth to sixth
            - Pull range control button up (high)
            - Double clutch, moving gearshift lever from fifth to sixth
            - As gear shift lever passes through neutral, transmission will automatically shift from low to high
            - Shift upward through tenth, using normal double clutching procedure

- Downshifting
    - Double clutch
    - Move gearshift lever from tenth to ninth
    - Repeat process through sixth gear
    - Push range control button down (low)
    - Double clutch moving gearshift lever from sixth to fifth
    - As lever passes through neutral transmission automatically shifts from high to low
    - Shift downward through first, using normal double clutching procedure

Visual 5 Controls and Shift Patterns: Fuller 13 Speed Roadranger, Two Transmissions Combined

13-Speed Roadranger

Two manual transmissions (a main and an auxiliary) combined with one gearshift lever

Controls

- Clutch
- Gearshift lever
- Range control button
- Splitter switch

Shift Pattern

- 13 forward speeds, two reverse
- Five speed front section
    - Low-low gear
    - First through fourth-low range

    - Fifth through eight-high range, split into
        - Direct drive
        - Overdrive
- First gear is in same position as fifth, second same as sixth, third same as seventh, and fourth same as eight.
- Splitter switch must be in direct position while transmission is in low range.

Shifting Procedures

- Upshifting
  - Depress clutch
  - Push range control button down (low)
  - Move splitter switch to direct drive
  - Move gearshift lever to low-low
  - Shift up through fourth gear using normal double clutching
  - Shifting from fourth to fifth
    - Pull range control button up (high)
    - Shift from fourth to fifth in normal manner
  - Shifting from direct to overdrive in same gear
    - Flip splitter switch to overdrive
    - Release accelerator
    - Depress and release clutch
    - Depress accelerator
    - Gearshift does not have to be moved
  - From overdrive to direct in next higher gear
    - Double clutch, moving gearshift lever from fifth overdrive to sixth
    - Flip splitter switch to direct (just before final clutch engagement)
    - Repeat procedure for seventh and eighth

- Downshifting
  - Shifting from overdrive to direct in same gear
    - Flip splitter switch to direct
    - Release accelerator
    - Depress and release clutch
    - Depress accelerator
    - Gearshift lever does not have to be moved
  - From direct drive to overdrive in next lower gear
    - Flip splitter switch to overdrive
    - Make normal shift
  - From fifth direct to fourth
    - Push range control button down (low)
    - Double clutch, moving lever from fifth direct to fourth

Visual 6 Controls and Shift Procedures with Two-Speed Rear Axle

Two-Speed Rear Axle

Rear Gear Ratios

- High
- Low
- No neutral (park and start in low speed)
- There are also three speed axles that work on the same principle

Controls

- Clutch
- Gearshift lever
- Two-speed selection switch (usually mounted on main gearshift lever)

Shift Pattern

Five-speed main box
Two-speed rear axle
Progress from first low to first high, second low to second high, etc. through fifth gear
Move from fourth low to fifth low, fourth high to fifth high
Different patterns, e.g., 1st through 3rd, then shift to 4th low, 5th low, 4th high, 5th high, etc.

Shifting Procedures

Preselect axle shift
Move range switch to high or low (as applicable)
Shifting axle from low to high (e.g., first low to first high)
  Keep accelertor down
  Move range control to up position (high)
  Release accelerator
  Pause until shift is complete (will be able to feel shift)
  Accelerate

Shifting from high to low (e.g., first high to first low)
  Accelerator down
  Push two-speed control switch down (low)
  Quickly depress and release clutch

Split shifting--high transmission gear--low axle speed (e.g., first high to second low)
  Make normal transmission shift to higher gear
  Push two-speed control switch down (before releasing clutch pedal)
  Release clutch and accelerate

Split shifting--low transmission gear--high axle speed (e.g., second low to first high)
  Accelerator down

  Pull two-speed control up
  Shift transmission to lower gear in normal way
  Accelerate

Visual 7 Techniques and Characteristics of Progressive Shifting

Progressive Shifting

NOTE: Students will be taught and practice progressive shifting techniques in the vehicle after they have mastered standard shifting.

Basic definition
Shifting before reaching maximum (governed) rpm

When used
Technique used on most fuel efficient engine/transmission combinations, e.g., Cummins, Caterpillar, Detroit

Procedure

- Upshifting
  - Shift when engine reaches cruise rpm rather than maximum set by governor
  - In lower gears shift at even lower rpm--the lowest possible without "lugging"
- Downshifting
  - Shift as soon as rpm reaches torque peak (1,300 rpm on most engines (check Operator's Manual)

Benefits of progressive shifting

- Reduces equipment wear
- Lowers noise level
- Saves fuel
- Recommended by many companies

3. SHIFTING AUTOMATIC AND SEMI-AUTOMATIC TRANSMISSIONS (10 minutes)

Visual 8 Controls and Shift Procedures: Allison Automatic, HT 750, DRD

Fully Automatic Transmissions

Basic control--range selector
Example--Allison Automatic Transmission, HT 750, DRD

Range Selector Positions

- Neutral (N)
  - Used when starting, standing, parking vehicle
  - Make sure parking brake on when standing or parking
  - Never coast in neutral, can result in transmission damage

- Reverse (R)
  - For backing vehicle
  - One gear in reverse range
  - Vehicle must be completely stopped before shifting from forward gear to reverse
  - Reverse warning signal activated in reverse position

- 2-5 or Drive
  - All normal driving conditions
  - Starts in 2nd
  - Upshifts to 3rd, 4th, 5th as accelerator depressed and engine speed increases
  - Downshifts automatically as vehicle speed slows down

- 2-3/2-4 lower range
  - Occasional road, load, traffic conditions make it desirable to restrict automatic shifting to lower range
  - Provides progressively greater engine braking effect
  - When condition requiring this range no longer in effect, shift back to higher range (Drive or 2-5)

- 2/Low gear
  - Used when pulling through mud and snow, driving up steep grade
  - Provides maximum engine braking power
  - Lower ranges (2/2-3/2-4) will not upshift above highest gear selected unless engine governor speed for that gear exceeded

- 1/Creeper gear
  - For off-highway use
  - Provides greatest tractive support
  - Never make full power shift from creeper gear to higher range

Upshifting and Downshifting with Automatic Transmission

- Upshifting--Using the accelerator
  - Pressure of foot on accelerator pedal influences automatic shifting
  - Fully depressed-transmission automatically upshifts near recommended governed speed of engine
  - Partially depressed--causes upshifts to occur sooner at lesser engine speed
  - Either method provides accurate shift spacing and control needed for maximum performance

- Downshifting
  - Occurs automatically
  - Systems prevent downshifting when engine speed too high until safe lower engine speed reached

- Using engine to slow vehicle
  - Shift range selector to next lower range to use engine as braking force

  - If vehicle exceeds maximum speed for lower gear, use service brakes to slow to acceptable speed
  - Automatic has longer "coast down" time than manual transmission
    - Driver must learn to decelerate sooner or use service brakes till downshift occurs

Visual 9 Semi-automatic Controls and Procedures

Semi-automatic Controls and Procedures

- Combines features of automatic and manual transmission
- No clutch used in most semi-automatics
  - Some use clutch at very low vehicle speeds, 3 mph and lower
- One control lever for each reverse and forward speed

Techniques

- Driver uses manual techniques to decide when shift, i.e., upshifts/downshifts when required by engine and road speed
- But does not have to manupulate clutch or other controls

Results

Has power shift advantages of automatic
Requires skill to recognize when to change gears

4. CONSEQUENCES OF IMPROPER SHIFTING (5 minutes)

Visual 10 List of Consequences of Poor Shifting Habits

Requirements for Proper Shifting

Sign of a professional driver: Never grinds, clashes, or forces the gears

Shifting Not a Matter of Strength

Can be done with strength of thumb and index finger only
If done correctly it practically "falls" into gear

Keys

Good timing and coordination (match road speed/rpm/with gear)
Knowing what gear the transmission is in at all times
Knowing for each gear top mph, maximum and minimum rpm
Anticipating changes in terrain and traffic

Important Knowledge

- Know the vehicle
- Know top tachometer readings for
  - Each gear
  - Each road speed
- Know the load and road, e.g., don't attempt to shift to a higher gear until trailer (not just the tractor) is over the hill crest

Results of Mistakenly Shifting Into Too Low a Gear

- Engine runs too fast
- Consequences
  - Clutch damage
  - Blown engine
  - Blown transmission
  - Twisted propeller shaft
  - Possible loss of vehicle control

Lugging

Driver fails to downshift when engine speed starts to fall below normal operating range.

Consequences
- Engine overheating
- Damage to drive train
- Stress on most vehicle systems

Improper shifting can affect life of all drive train components

5. SUMMARY AND RANGE PREPARATION (5 minutes)

Summary of Good Shifting Habits

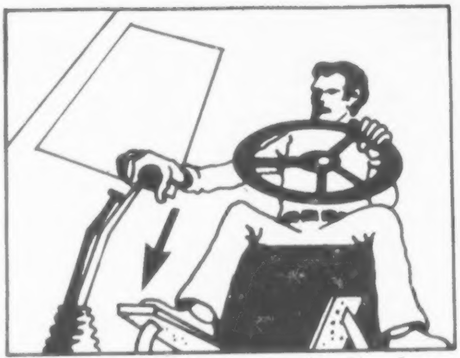
Know shift pattern of vehicle
Start vehicle in lowest gear
Use clutch brake properly
Upshift smoothly
Use progressive shifting
Downshift at precise point/time required
Use double clutching technique
Avoid snapping or riding the clutch
Use tachometer and speedometer to determine shift requirements
Avoid lugging or over revving the engine
Don't force the transmission into a gear
Avoid overloading rig, drive train cannot handle it

Preparation for Range Exercises

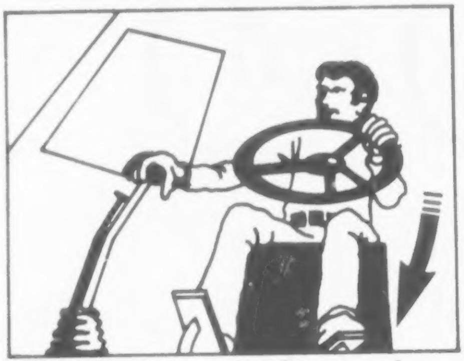
- Describe range exercises in Lesson 2
- Inform students of types of transmission(s) that will be used
- Provide shifting diagrams for advance study

Visual 1

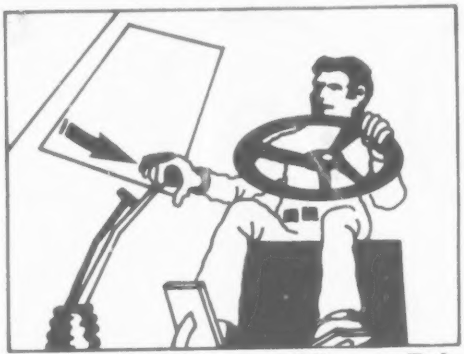
Key Elements of Shifting



Accelerator–Controls Fuel to Engine



Clutch–Controls Connection Between Engine and Transmission

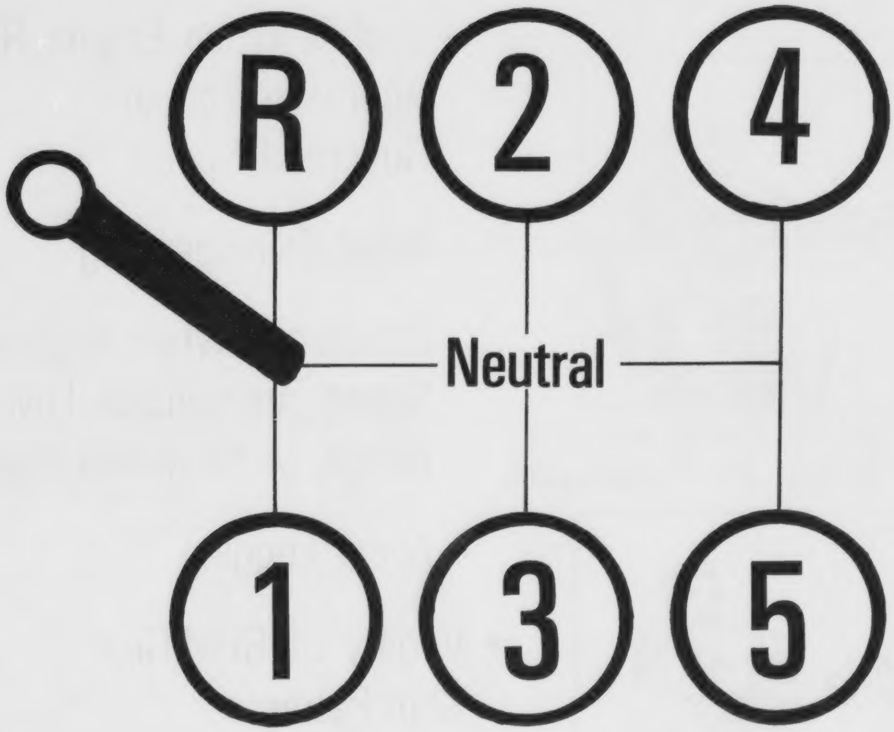


Gear Shift Lever–Allows Driver to Select Gears in Transmission

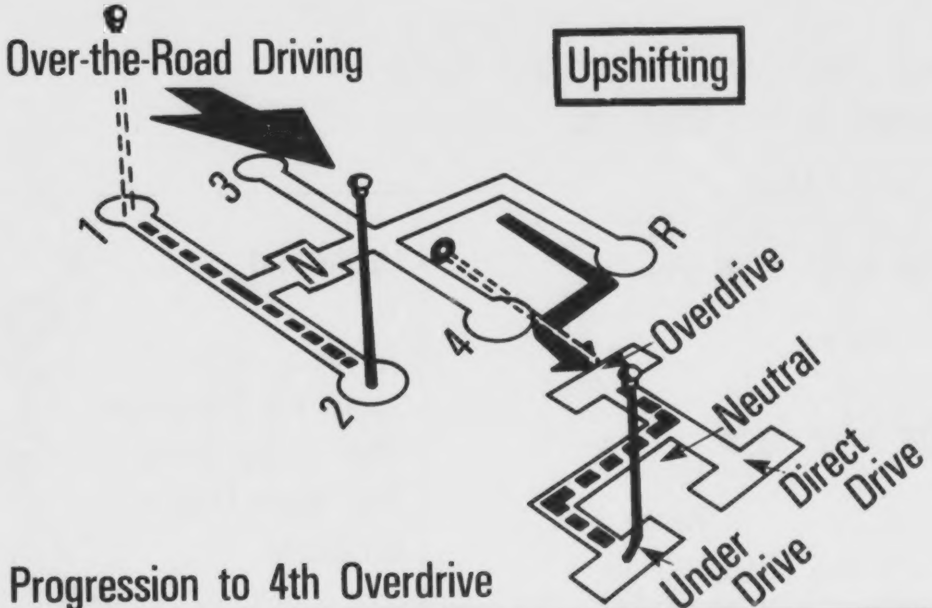
- Match Engine Speed (RPM) to Transmission Speed
- Shift Smoothly to Avoid Clashing Gears
- Shift by the Tachometer
  - –Upshift When Engine RPMs Approach Top of Governed Speed
  - –Avoid Overspeeding
  - –Downshift When Engine Speed Approaches Low Range of Governed Speed
  - –Avoid Lugging
- Variety of RPM/Gear Shift Patterns
- Learn RPM/Shift Pattern of Vehicle You Drive!

Visual 2

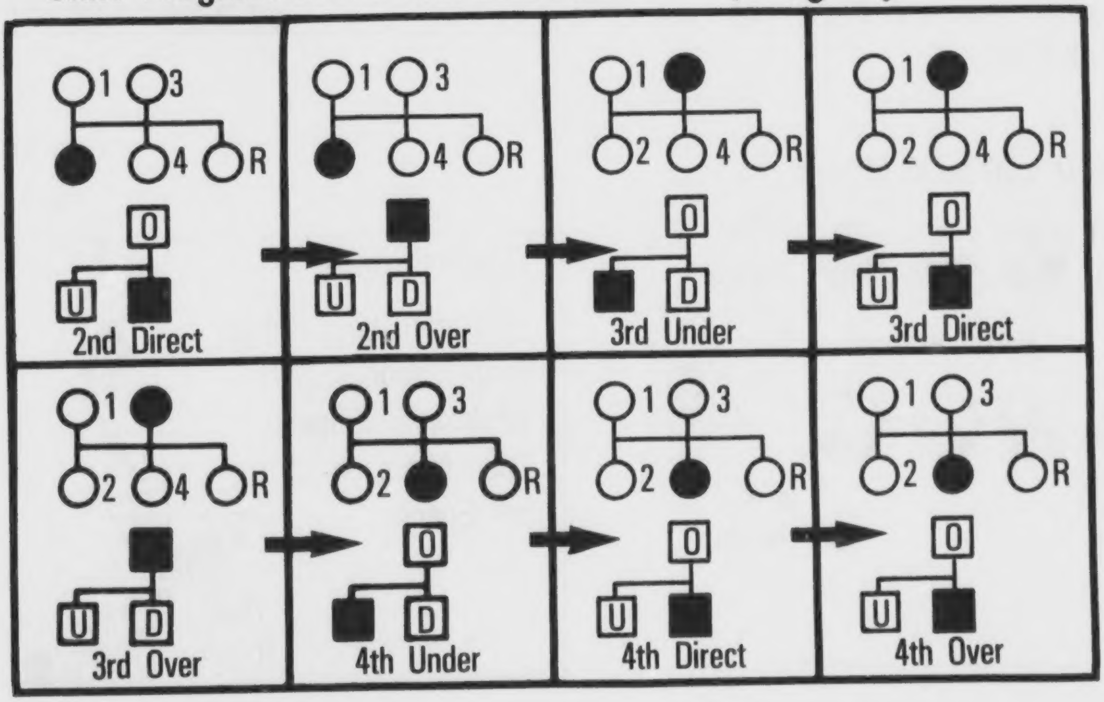
Controls and Shift Patterns:
Clark 5 Speed


R
2
4
Neutral
1
3
5

Controls and Shift Patterns: Spicer 4×3


Over-the-Road Driving
Upshifting
1
2
3
4
N
R
Overdrive
Neutral
Direct Drive
Under Drive

Shift Progression to 4th Overdrive


1
3
4
R
O
U
D
2nd Direct
2nd Over
3rd Under
3rd Direct
3rd Over
4th Under
4th Direct
4th Over
2

READEX FICHE

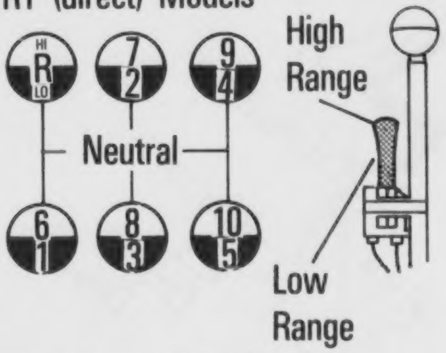
Visual 4

Controls and Shift Patterns:

10-Speed Road Ranger

Gear Shift Lever Pattern and Range Control Button Positions

RT (direct) Models

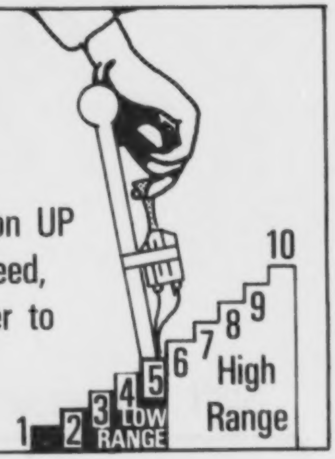


HI
R
LO
7
2
9
4
High Range
Neutral
6
1
8
3
10
5
Low Range

Shift 1-2-3-4-5 in Low Range.
Repeat Pattern in High Range and Shift 6-7-8-9-10

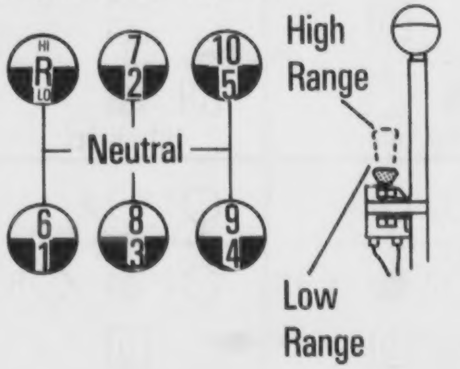
Upshifting

To Get to High Range Pull Button UP While in 5th Speed, Then Move Lever to 6th Speed.



1
2
3
4
5
LOW RANGE
6
7
8
9
10
High Range

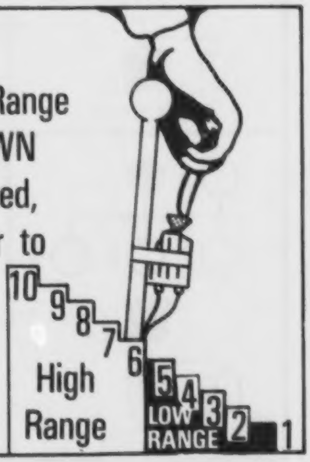
RTO (overdrive) Models



HI
R
LO
7
2
10
5
High Range
Neutral
6
1
8
3
9
4
Low Range

Downshifting

To Get to Low Range Push Button DOWN While in 6th Speed, Then Move Lever to 5th Speed.



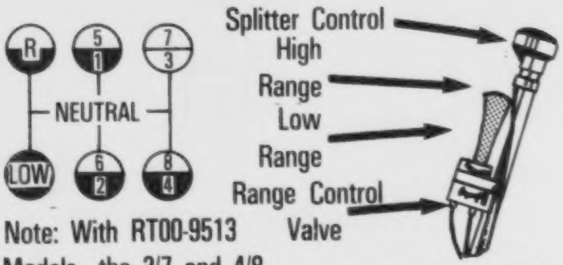
10
9
8
7
6
High Range
5
4
3
2
1
LOW RANGE

Visual 5

Controls and Shift Patterns:

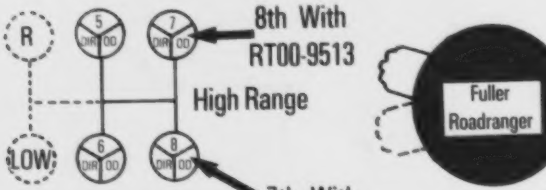
13-Speed Road Ranger

Gear Shift Lever Pattern and Selector Valve Positions


R
5
1
7
3
NEUTRAL
LOW
6
2
8
4
Splitter Control
High Range
Low Range
Range Control Valve

Note: With RT00-9513 Models, the 3/7 and 4/8 Lever Positions Are Reversed

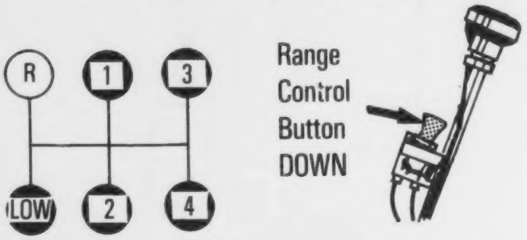
Do Not Range Shift When in Reverse


R
5
DIR
OD
7
LOW
6
8
8th With RT00-9513
High Range
7th With RT00-9513
Fuller Roadranger

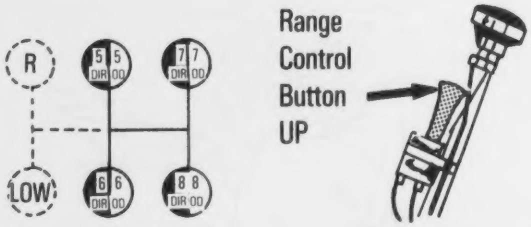
High Range Ratios Are Split With an Overdrive Splitter Gear

Shifting Sequence

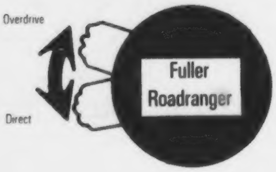
While in Low Range, Shift This Pattern....


R
1
3
LOW
2
4
Range Control Button DOWN

While in 4th speed of Low Range, Pull Up Range Control Button, and Shift This Pattern ...


R
5 5
DIR OD
7 7
DIR OD
LOW
6 6
DIR OD
8 8
DIR OD
Range Control Button UP

...Using Splitter Valve to Split the High Range Ratios ...


Overdrive
Direct
Fuller Roadranger

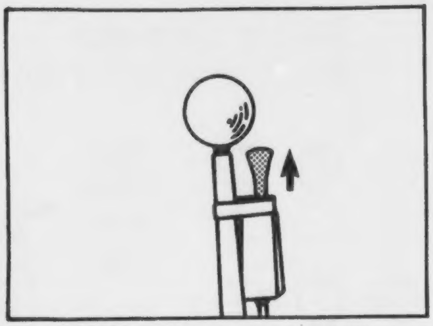
Shift Sequence

Low Range	High Range
Low	5D
1	5OD
2	6D
3	6OD
4	7D
	7OD
	8D
	8OD

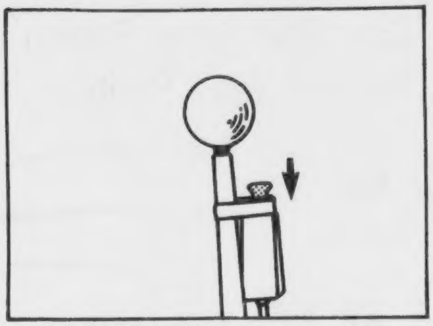
Visual 6

Controls and Shift Procedures With Two-Speed Rear Axle

Two-Speed Axle Selector on Shifter Lever

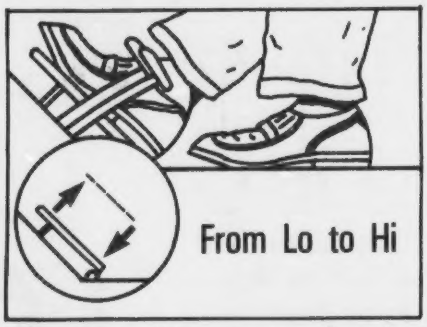


Shifter Button Up (HI)

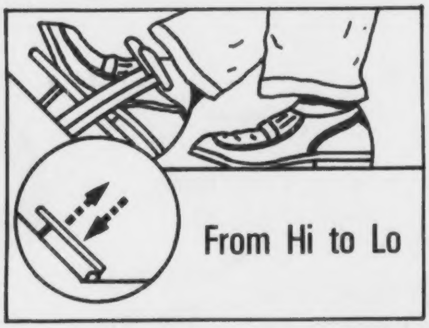


Shifter Button Down (LO)

Corresponding Accelerator Action for Shifting Above Selection



Up, Pause, and Down on Accelerator



Up and Down on Accelerator Quickly Without Declutching. Or Hold Accelerator Down While Disengaging and Reengaging Clutch as Quickly as Possible.

Typical Shift Sequence Chart

Gear Shift Sequence

1-LO → 1-HI
2-LO → 2-HI
3-LO → 3-HI
4-LO → 4-HI
5-LO → 5-HI

Visual 7

Progressive Shifting

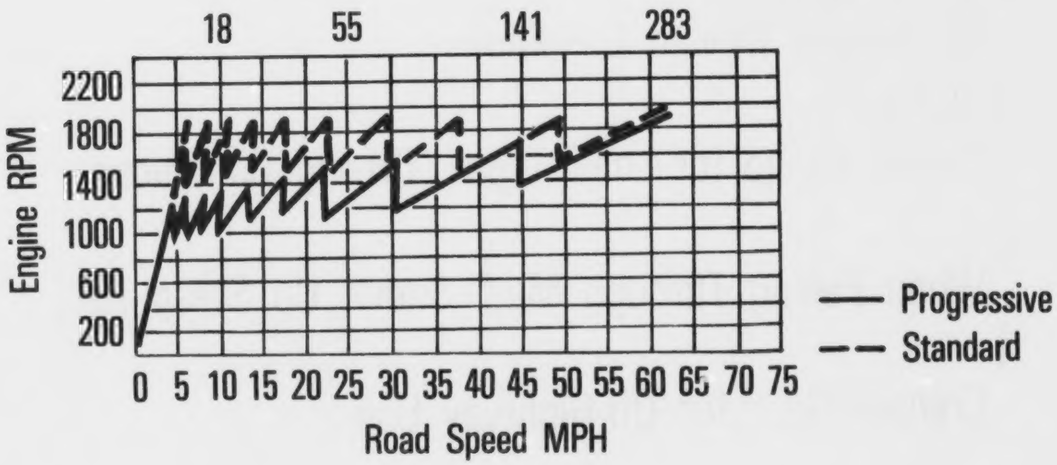
Technique Used With Some Engine/Transmission Combinations

- Shift Much Like Automobile
- Gradually Increase
- No Need to Accelerate to Governor Unless Maximum Power Required
- Available in Some Engine/Transmission Combinations
- Use Only if Engine and Company Policy Allow
- Advantages
  - Reduces Equipment Wear
  - Lowers Noise Level
  - Saves Fuel

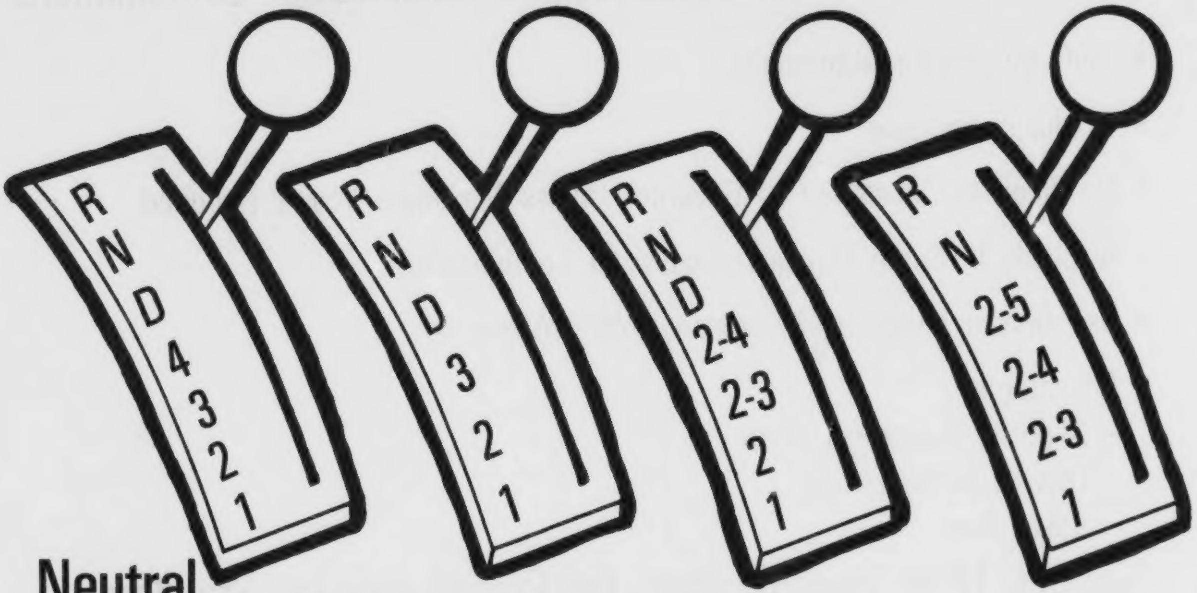
Example: RPM Requirements for Progressive vs. Standard Techniques

10 Speed Transmission Gear Split/1900 RPM

Gross HP (Required for 70,000 lbs. & 94 sq. ft. Frontal Area)



Controls and Shift Procedures: Fully Automatic Transmission



Neutral

Use When Starting, Standing, Parking

Reverse

Vehicle Must Be Completely Stopped Before Using

2-5 or Drive

All Normal Driving Conditions

2-3/2-4

Lower Range for Load Types, Driving Conditions

2

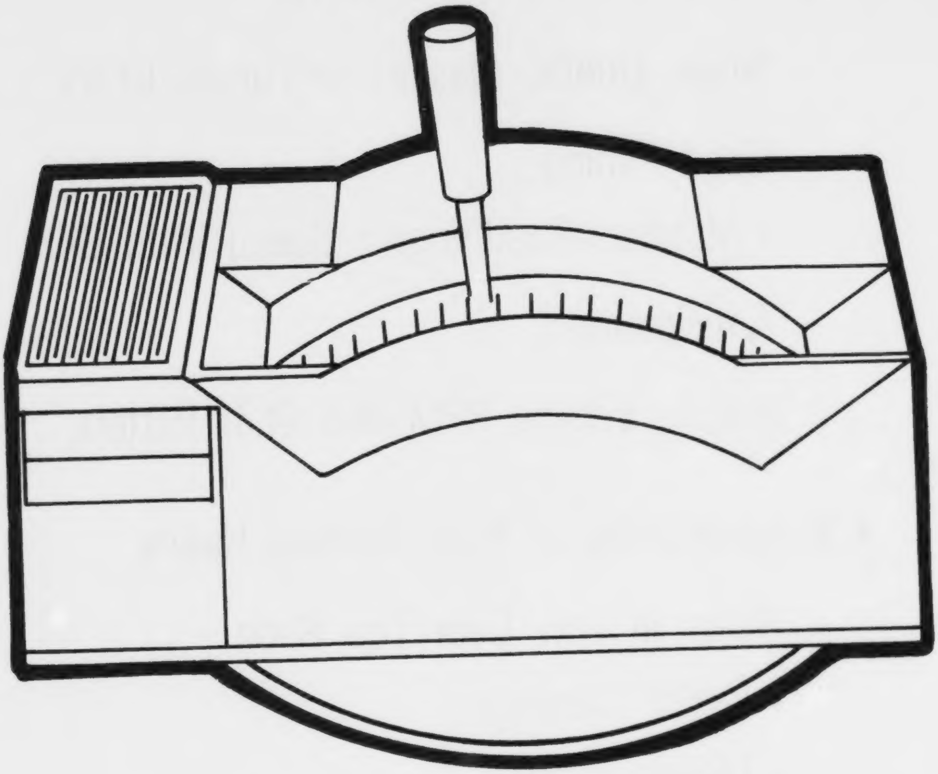
When Pulling Through Mud, Snow, Up Steep Hills

1

Creeper Gear for Off-Highway Use

Visual 9

Semiautomatic Transmission



- Combines Features of Automatic and Manual
- No Clutch
- One Gear Shift Lever With Notches for Each Speed
- Driver Must Know When to Upshift and Downshift

List of Consequences of Poor Shifting Habits

- Signs of a Professional Driver
  - Never Grinds, Clashes or Forces Gears
  - Good Timing
    - Matches Road/Engine Speed With Gear
  - Anticipation
  - Knows Vehicle RPM and Shift Pattern

- Consequences of Poor Shifting Habits
  - Shifts in Low Gear Too Soon
    - Clutch Damage
    - Blown Engine
    - Blown Transmission
    - Twisted Propellor Shaft
  - Shifts to High Gear Too Late
    - Engine Overheating
    - Damage to Drive Train

LESSON 2 DEVELOPMENT OF SHIFTING SKILLS (RANGE)

Overview

Time Allotted: 3 hours

Prerequisites: Unit 1.5, Lesson 1

Purpose:

The purpose of this lesson is to develop student ability and to give practice in shifting tractor transmissions. Following an instructor demonstration, each student will practice on the driving range for a minimum of 45 minutes each. The instructor will observe students and critique their performance.

Materials

Instructional Aids

None

Student Material

Range Safety Rules, in Unit 1.1 of Student Manual

Double Clutching Technique, in Unit 1.5 of Student Manual

Diagrams of gear shift patterns for training vehicle(s) being used for this lesson

Instructor Material

Range Diagram for Exercise 1 (at end of lesson)

Equipment

Tractor-trailer and range equipment shown on the Range Diagram

Content

Activity or Topic	Approximate Time
1. DEVELOPMENT OF SHIFTING SKILLS	3 hours

1. DEVELOPMENT OF SHIFTING SKILLS (3 hours)

Purpose

The purpose of this exercise is to provide students with practice upshifting and downshifting in the first three forward transmission gears.

Range Layout

See Range Diagram, Exercise 1.

Directions

1. Divide students into groups of three. Assign each group to one instructor/vehicle.

2. Instructor reviews and demonstrates shifting techniques.

3. One student at a time accompanies instructor as he demonstrates the exercise (if sleeper cab available, all three students may observe).

    Instructor drives path of travel beginning in first gear, accelerating to second then third.

    Decelerates and downshifts through first gear.

    Stops vehicle even with range markers at opposite end of range.

    Backs the vehicle into original starting position for student practice.

4. Each student in turn is accompanied by the instructor as student completes initial exercise.

    Begin from in first gear, accelerate, shift to second, then third gear.

    Decelerate, downshift to second, then first.

    Bring vehicle to stop.

    Backs vehicle in a straight line back to the starting position of exercise, this provides additional reinforcement of training already given in Unit 1.4

5. Additional practice up to another 1 hour per student should be allowed.

6. Instructor may direct additional practice from outside the cab.

Observation

The instructor will observe for failure to perform the following procedures properly:

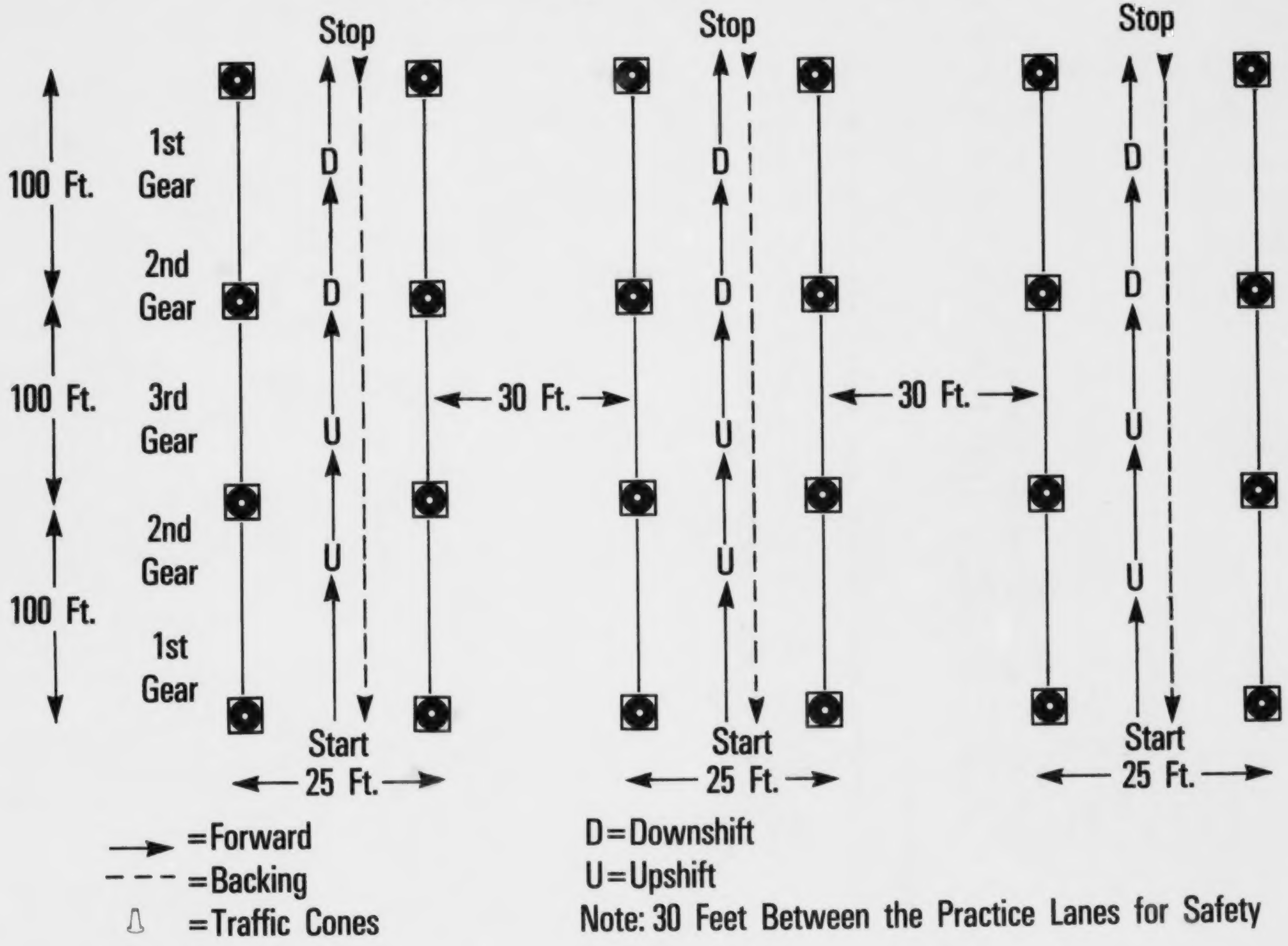
Starting the engine
Warmup
Shutdown
Braking/stopping
Double clutching
Upshifting
Downshifting
Speed control
Straight line backing
Improper use/abuse of vehicle components
Securing vehicle properly (parking) before getting out to allow next student his/her turn at wheel

Evaluation

Student performance will be evaluated against the following criteria:

Over revving
Lugging
Excessive rpm drop (more than 500 rpm)
Missed shifts

Range Diagram—Exercise 1


Stop
Stop
Stop
100 Ft.
100 Ft.
100 Ft.
1st Gear
2nd Gear
3rd Gear
2nd Gear
1st Gear
D
D
U
U
30 Ft.
30 Ft.
Start
Start
Start
25 Ft.
25 Ft.
25 Ft.
→ =Forward
- - - =Backing
=Traffic Cones
D=Downshift
U=Upshift
Note: 30 Feet Between the Practice Lanes for Safety

UNIT 1.6
BACKING

UNIT 1.6 BACKING

PURPOSE

The purpose of this unit is to prepare students to back tractor-trailers safely.

OBJECTIVES

Performance Objectives

Students must be able to

- back in straight line and curved paths.
- back into an alley dock.
- parallel park.
- park in a jackknife position.
- judge side, rear, and overhead clearances and path of the trailer.

Students must

- get out and check to the rear before backing.
- warn others that truck is backing.
- use mirrors to check path and clearances while backing, on long distances, stop, get out and recheck path.

Knowledge Objectives

Students must know

- the procedures for backing and alley dock, parallel and jackknife parking.
- the correct position in which to place the vehicle before beginning backing maneuvers.
- the principles of reverse-steering an articulated vehicle.
- the hazards of backing, the importance of avoiding unnecessary backing and blind-side backing, and the importance of checking the area prior to backing and of using a guide for assistance.

Skill Objective

Students must be able to coordinate speed and direction controls to achieve the desired path while backing.

Attitude Objectives

Students must believe

- all backing is potentially hazardous.
- the best way to avoid backing accidents is by avoiding the need to back.
- all backing accidents can be avoided.

LESSONS

Lesson 1.	**Backing Procedures (Classroom)**	**45 minutes**
Lesson 2.	**Development of Backing Skills (Range)**	**22 hours**

LESSON 1 BACKING PROCEDURES (CLASSROOM)

Overview

Time Alloted: 45 minutes

Prerequisites: Unit 1.5

Purpose:

The purpose of this lesson is to present the principles, procedures, and safety rules related to backing a tractor-trailer combination. There is a description of the basic backing maneuvers--alley dock, jackknife and parallel--which will be practiced on the range. In addition to preparing students for range activities, this lesson will stress the hazards of backing and the need for student practice and patience in mastering backing skills.

Materials

Instructional Aids

Visuals 1-9

Student Material

Principles of Backing Tractor-Trailers, in Unit 1.6 of Student Manual
Safe Backing Checklist, in Unit 1.6 of Student Manual

Instructor Material

Model (toy) tractor-trailer, with steerable front axle, for classroom demonstration of reverse steering principles as a supplement to the Visuals 1-8.

Content

Activity or Topic	Approximate Time
1. BACKING: PRINCIPLES AND RULES	20 minutes
2. FOUR BASIC BACKING MANEUVERS	15 minutes
3. SUMMARY AND RANGE PREPARATION	10 minutes
	45 minutes

1. BACKING: PRINCIPLES AND RULES (20 minutes)

Visual 1 Diagram of Tracking Principles When Backing Tractor-Trailer

Steering While Backing

Difficult to learn and perform
Requires patience and practice to develop judgmental skills

Steering Principles

- Steer in opposite direction of desired trailer path
- Rear tractor axle functions as trailer steering axle
  - Direction of tractor wheels determine direction of trailer
  - Changing direction of tractor "steers" the trailer

- Process of backing
  - Involves combination of "jacking" and "chasing"
  - Jacking
    - Turning the tractor causes a "jackknife", i.e., an angle between tractor and trailer
    - This starts trailer turning
  - Chasing
    - Once the trailer is going the correct direction, the tractor is turned just enough to follow or chase the trailer

- Trailer Response to Tractor Steering
  - Front tractor wheels turned left, trailer goes right
  - Front tractor wheels turned right, trailer goes left

- Correcting Drifts From Desired Path
  - Turn steering wheel in direction of drift
  - Slight movement required as soon as the drift occurs
  - Do not oversteer

Demonstration

- Using a model tractor-trailer, demonstrate steering principles
  - Have students assemble around table top
  - Move tractor-trailer through several backing maneuvers
  - Explain in terms of "jacking" and "chasing"
  - Have students take turns backing model

Visual 2 Examples of backing maneuvers

Types of Backing Maneuvers

Straight Line Backing

- Backing in a straight line
- Simplest to learn
- Fundamental to all other backing manuevers

Alley Dock

- Backing while turning 90°
- Used at loading docks
  - Must back off of street
  - Drive between two vehicles

Parallel Parking

- Backing into a space along a curb or dock
- Most difficult backing maneuver to perform

Jackknife Position

- Refers to final parked position of the rig
  - Tractor and trailer at jackknife angle
  - Shortens length of rig
- Required under certain docking conditions
  - Obstructions
  - Dock too close to street
  - Parking for side loading/unloading

Sight Side Backing

- Backing toward left side of vehicle
- Driver can see along intended path of the trailer

Blind Side Backing

- Braking toward right side of vehicle
- Much more difficult than sight side
- Can use mirrors only
- For safety reasons always avoid blind side backing when possible

Visual 3 Rules for Safe Backing

General Rules for Backing Safely

Avoid Backing When Possible

Check Clearances Before Starting

- Be sure vehicle is secured
- Leave cab
- Check above
- Check to the sides
- Check under the vehicle
- Check behind vehicle for obstructions:
  - Before starting
  - Recheck if start delayed
  - Periodically if long backup
- Check front for adequate swing clearance

Use Helper When Possible

- To aid in checking clearance
- To give directions
- Driver still responsible for results (damage)
- Must agree on signals in advance to avoid confusion
- Must be in position so driver can see helper in rearview mirror(s) at all times
- If helper not visible, stop immediately

Use Horn and Flashers

- Activate warning flashers prior to moving into reverse gear
- If vehicle not equipped with a backup alarm, give gentle tap on electric horn periodically

Keep Window Open and Radio Off--In order to hear any warning noises

General Backing Procedures

Start in Proper Position

- Key to backing
- Positions differ by type of backing maneuver
- Put vehicle in position by forward movement
- Stop, secure vehicle, get out and check position
- Appropriate initial position will be discussed for each maneuver

Back Slowly

- Back as slowly as possible
- Use lowest reverse gear
- Don't accelerate
- Use idle speed
- Don't ride the clutch
- Keep off all pedals until stopping

Constantly Check Behind When Backing

- All backing to be done with mirrors
- Keep doors closed
- Watch behind tractor tires during "jack"
  - Particularly important in blind side backing
  - Objects not visible until just before collision (e.g., parked cars)
- Watch for things that could tilt trailer (e.g., curb)
- Watch for overhead structures (wires, pipes, tree limbs, window air conditioners)

Start Over When Necessary

- Pull up and realign trailer with desired path whenever too far out of position
- Always better to pull forward to correct steering errors than to "fight it" by continuing to back
- Select path that will align rig properly to target before pulling forward

Visual 4 Truck Backing Across the Street

Use of Backing Procedures on the Job

- Backing and maneuvering into docking areas is essential part of the driver's job
- Backing situations may also come up on the street, e.g., parallel parking
- Backing across a street
  - Illegal, but sometimes necessary maneuver
  - Maneuver vehicle to back from sight side
  - Safer to block entire street rather than just part of it
    - Other vehicles won't be tempted to go around you
    - Use a helper to direct traffic
  - Remember--Driver will be liable for any accidents in this situation

2. FOUR BASIC BACKING MANEUVERS (15 minutes)

Straight-Line Backing

Position, Vehicle and Wheels Straight

- Visualize imaginary straight line as trailer path
- Use push-pull method of steering (discussed in Unit 1.4)

Visual 5 Alley Dock Backing

Alley Dock Backing

Procedure

- Step 1 - Approach alley at right angle
  - Approach on right side so traffic can't get in
  - Check left mirror to make sure no one is on left
  - Turn to left to pull trailer backend as close to alley as practical
  - Check right mirror to make sure no one is on right side
  - Turn right to pull front of trailer to right
  - Then cut to left
  - Tractor and trailer should be targeted
- Step 2 - Turn wheel to right when tractor passes center spot of alley

Step 3 - Stop with the rig in an arc so you can see left rear corner of trailer and the intended "target"
  Straighten steering wheel
Step 4 - Check clearance behind
  Check distance between other trailers
  Open rear doors if insufficient clearance to do so later
 Begin backing into alley
  Get back in cab
  Visualize imaginary line curving back to alley
  Start backing
   "Jack" tractor to start trailer along path
   Go slow
   Give warning
   Constantly check path
   Make adjustments
Step 6 - Straighten wheels to "chase" trailer
  Trailer enters alley
  Put in position for straight line backing
  Use straight line backing procedure
Step 7 - Stop and check behind again
  Stop about 3 or 4 feet from dock
  Apply brakes and secure vehicle
  Walk to dock to check remaining space (not necessary if there is a qualified helper or guide)
  Open rear doors before trailer gets to the door
Step 8 - Ease vehicle to dock

Visual 6 Jackknife Backing (Sight Side)

Jackknife Parking

Procedure--Sight Side

Step 1 - Position vehicle properly, i.e. pull past dock while parallel to it (see Step 1 in alley dock)
Step 2 - Check clearance
Step 3 - Visualize path of trailer with imaginary line
Step 4 - Follow general backing procedure
Step 5 - Watch for rear wheels to reach turning point (approximately midway point of alley)
Step 6 - Turn steering wheel to right
  The trailer should be backing in a line that will allow the tractor to follow (approximately at a 15° angle)
Step 7 - When trailer is about to make contact with dock, turn steering wheel sharply to the right. This will give the 90° jackknife position
  Make sure air and electrical lines are long enough and won't be torn off

Visual 7 Jackknife Backing (Blind Side)

Procedure--Blind Side

Never do this maneuver if possible to avoid it, always use a guide or helper

Step 1 - Position vehicle properly (same as sight side--see Step 1 in Alley Dock)
Step 2 - Check area that you will be backing into
Step 3 - Visualize trailer path of travel
Step 4 - Follow general backing rules
Step 5 - Watch for rear wheels to reach turning point
Step 6 - Turn steering wheel to the left--trailer will move right
  Trailer should be backing in a line that will allow tractor to follow
Step 7 - When trailer is about to make contact with dock, turn steering wheel sharply to the left. This will give the 90° jackknife angle.

Caution: More than 90° angle must be avoided

Trailer will move forward
Rear corner of tractor will hit trailer
Could tear off air and electrical lines
Best not to even approach 90° (80° should be sufficient)

Visual 8 Parallel Parking

Parallel Parking--the hardest of the four maneuvers described

Procedure

Step 1 - Position tractor-trailer properly
  Drive past front of parking space, parallel to it
  Stop when trailer is approximately 3 feet from end of space
Step 2 - Check area to be backed into
Step 3 - Start backing, keeping wheels straight
Step 4 - Turn steering wheel slightly to the left when vehicle starts backing
  Trailer should be entering space at approximately 15° angle
  Continue backing

Step 5 - Turn steering wheel more to the left making sure back right side of trailer is heading toward back right side of space
  Continue until front of trailer is even with front of space
Step 6 - Turn steering wheel sharply to the right
  Continue backing until tractor is even with front of parking space (jackknife position)

Step 7 - Turn steering wheel sharply to the left
Continue backing until tractor-trailer is within parking space
Step 8 - Pull unit forward, adjust clearance evenly front and back

3. SUMMARY AND RANGE PREPARATION (10 minutes)

Visual 9 A Picture of a Careless Backing Accident

Hazards of Backing

Most difficult procedure to master
Many drivers have spoiled a good safety record with a moment of careless backing

Keeping Safety in Mind When Backing

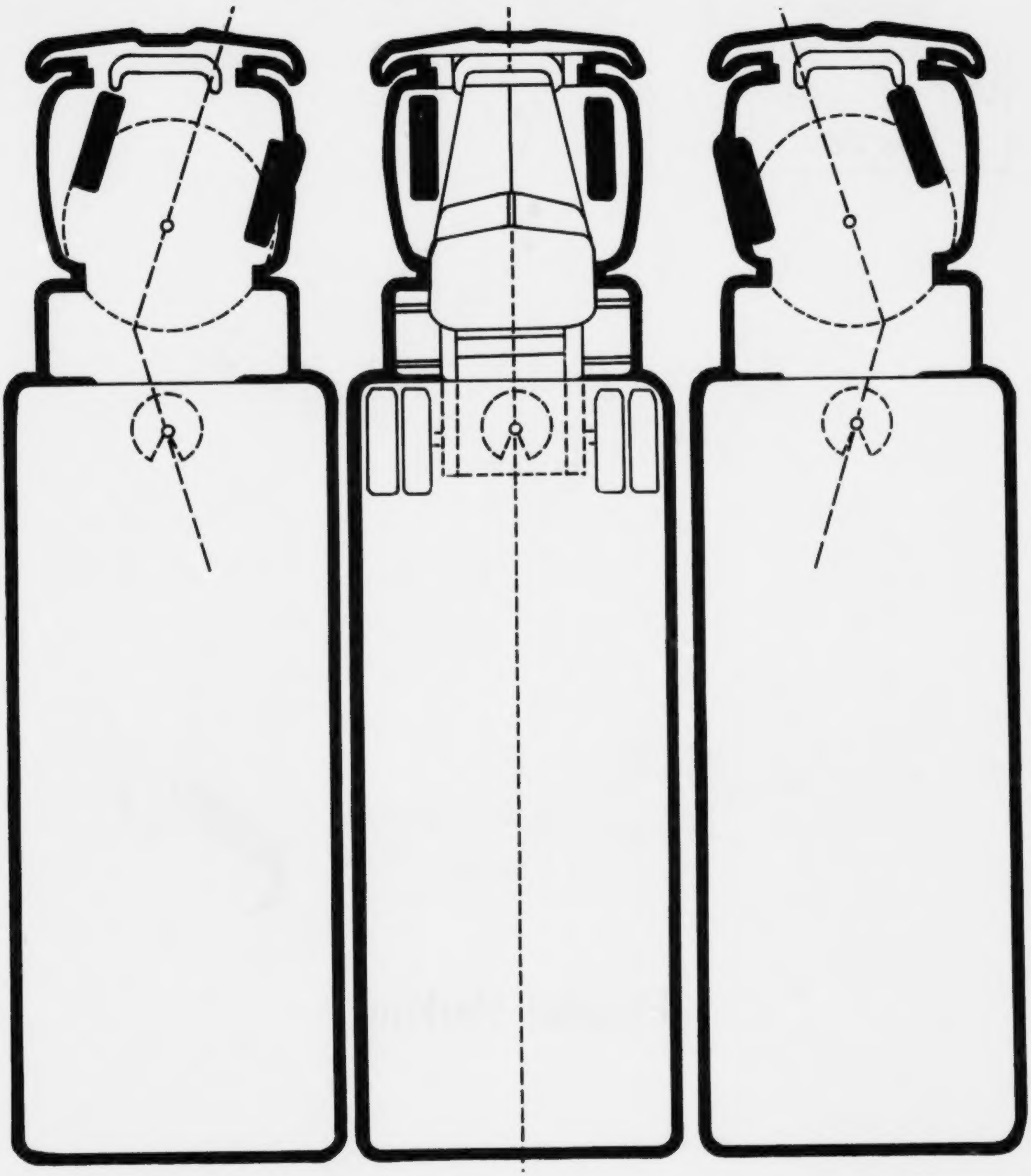
Walk behind vehicle before entering cab
Know your vehicle
Align mirrors for maximum view
Use helper when possible
Back slowly
Sound horn, flash lights
Avoid blind side backing

Review Driving Range Safety Rules Again

Have students review these rules in Unit 1.1 of the Student Manual

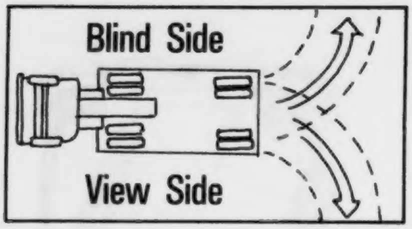
Visual 1

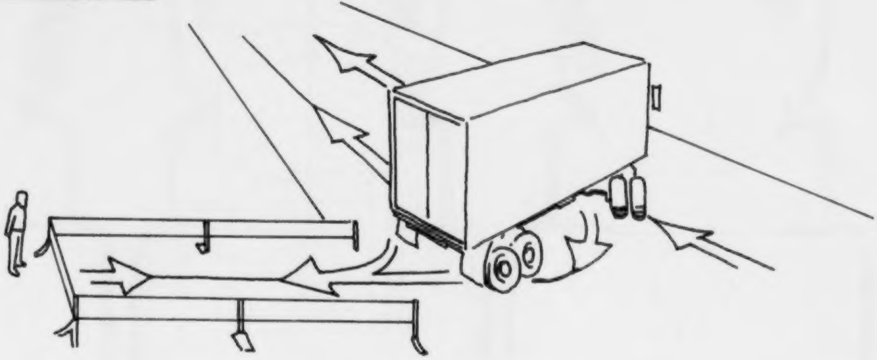
Tracking Principles When Backing Tractor/Trailer

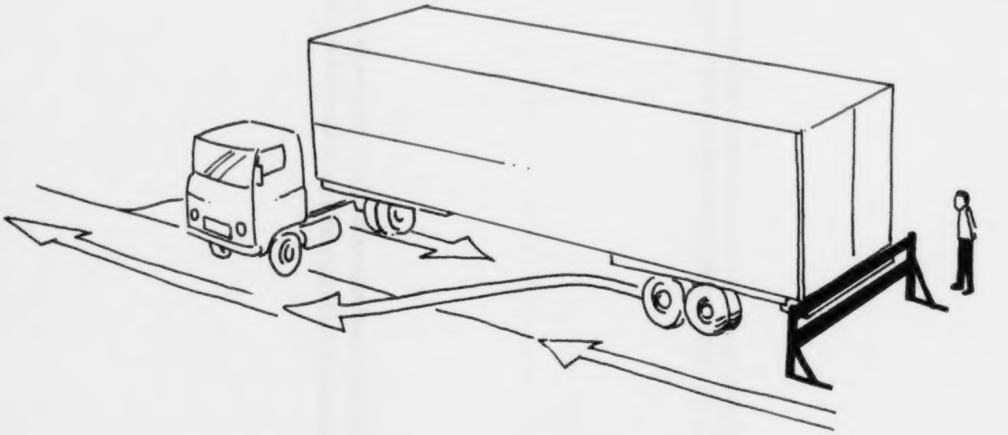


Visual 2

Example of Backing Maneuvers


Blind Side
View Side





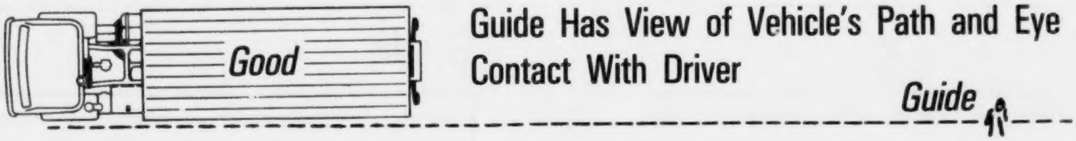
Parallel Parking

Visual 3

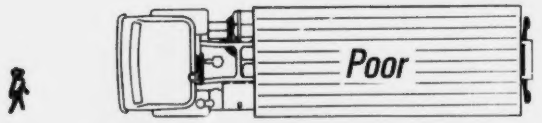
Rules for Safe Backing

- Avoid Backing When Possible
- Check Clearances Before Starting
- Use Helper When Possible
- Use Horn and Flashers
- Keep Window Open and Radio Off
- Start in Proper Position
- Back Slowly
- Constantly Check Behind
- Start Over When Necessary

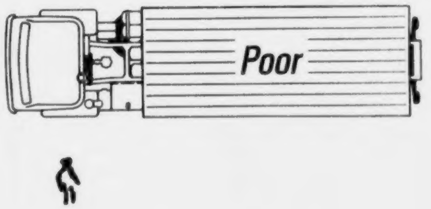
Use of Helper or Guide



Guide Has View of Vehicle's Path and Eye Contact With Driver



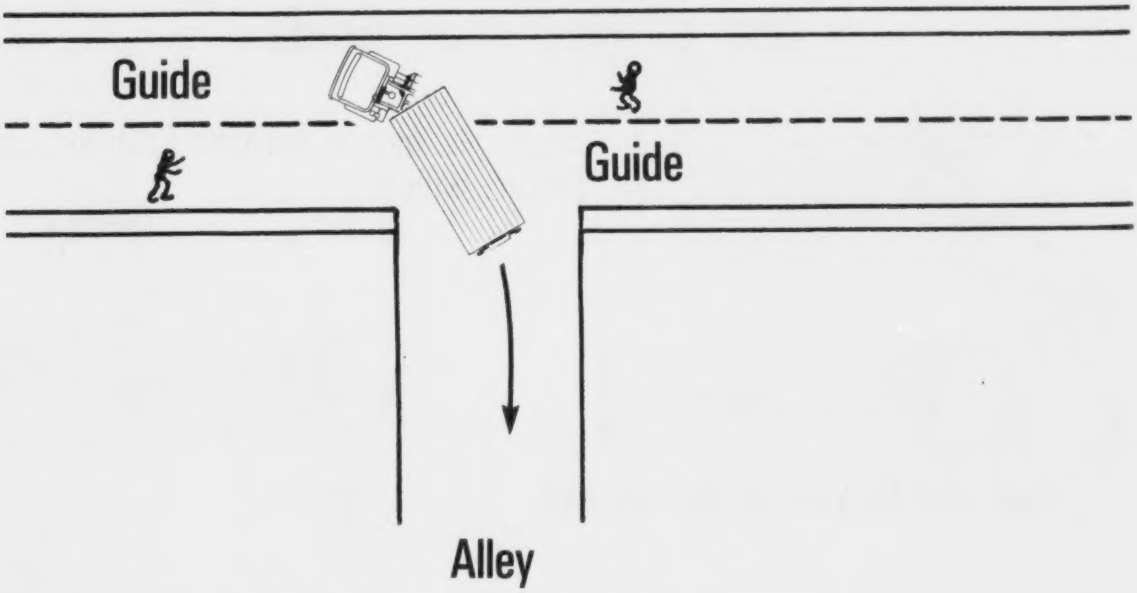
Guide Has No View of Vehicle's Path.



Visual 4

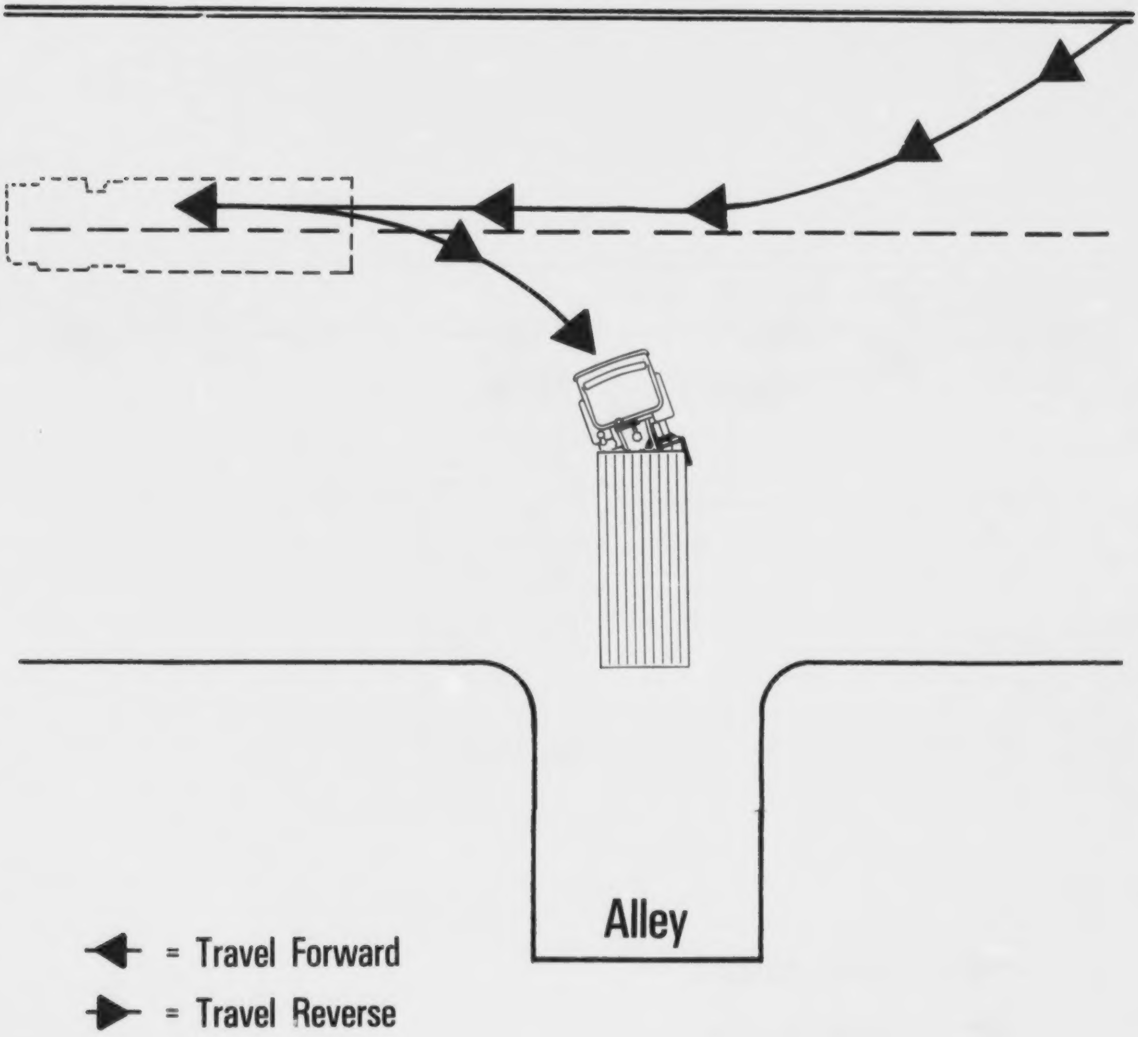
Truck Backing Across Street

- Illegal but Sometimes Necessary
- Maneuver Vehicle to Back From Sight Side
  - If Necessary, Drive a Block and Turn Around to Avoid Blind Side Backing
- Use a Helper
- Safer to Block Off Entire Street Than Part of Street
  - Vehicles Won't Be Tempted to Go Around You
- Driver Is Responsible for Any Accidents!



Visual 5

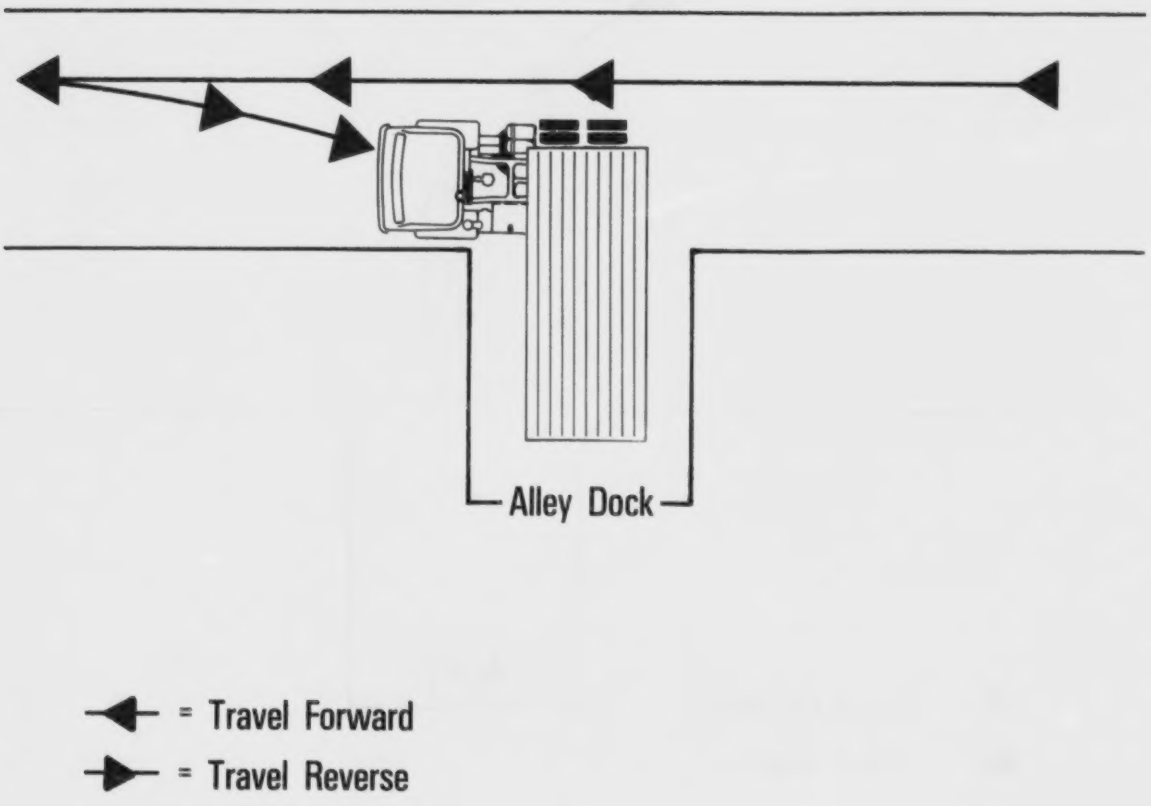
Alley Dock Backing


Alley
= Travel Forward
= Travel Reverse

Visual 6

Jackknife Backing

(Sight Side)

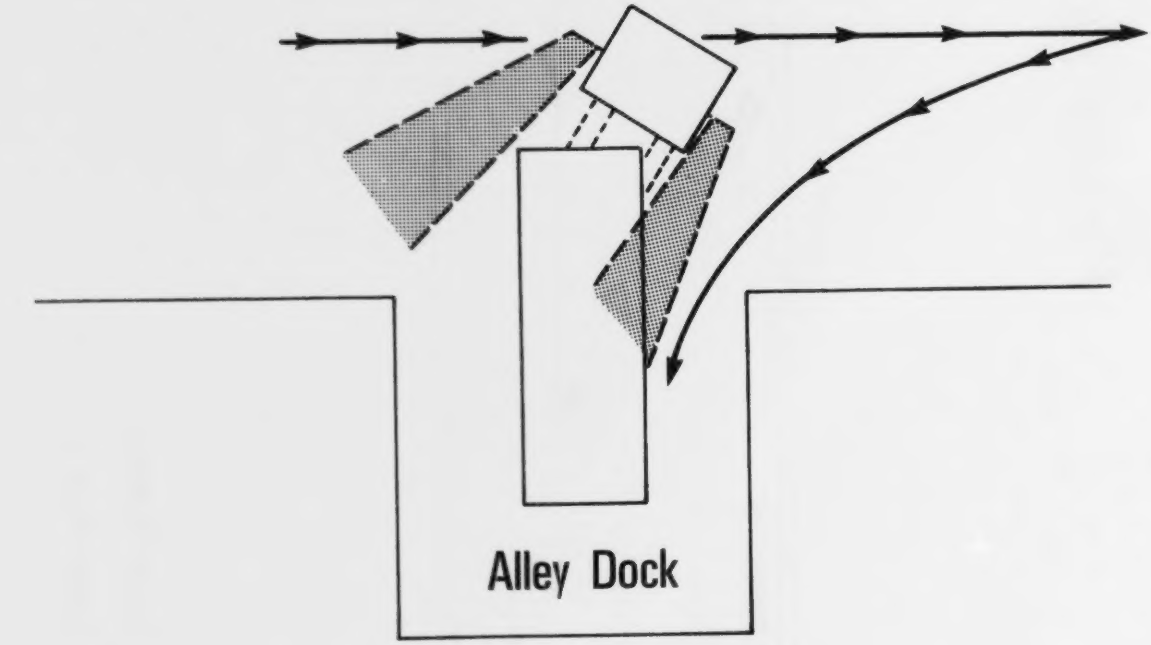

Alley Dock
= Travel Forward
= Travel Reverse

Visual 7

Jackknife Backing

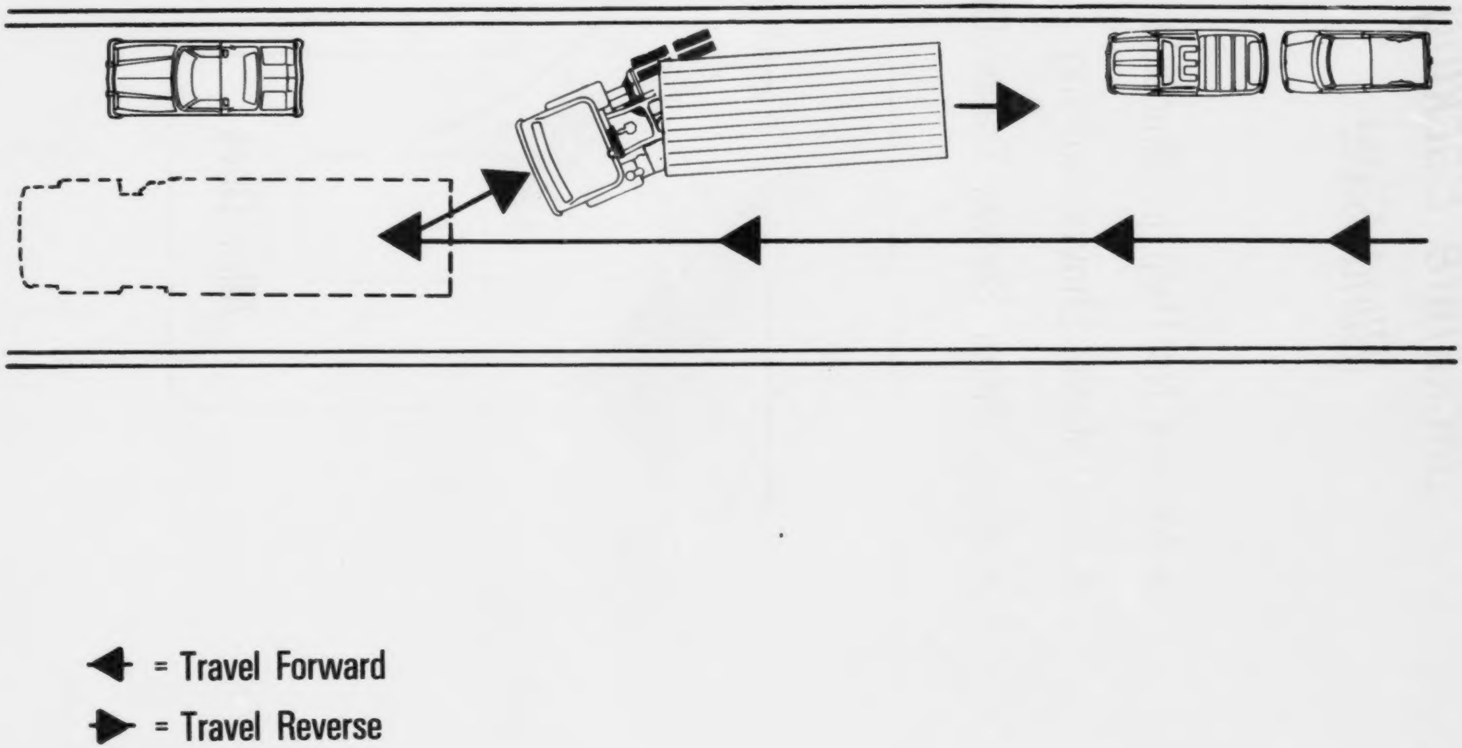
(Blind Side)

- Mirrors No Help in Blindside Backing
- Left Mirror Shows Nothing
- Right Mirror Shows Trailer Only



Visual 8

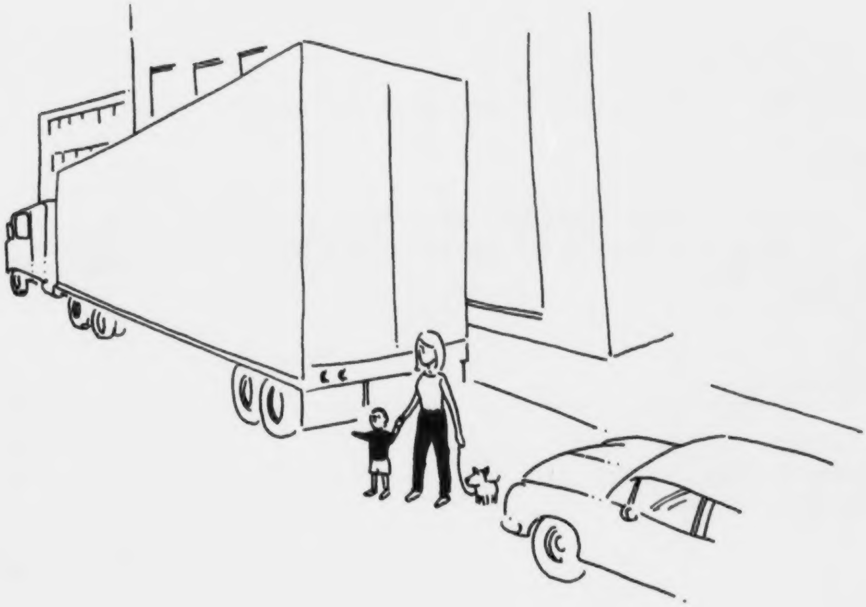
Parallel Parking


◀ = Travel Forward
▶ = Travel Reverse

Visual 9

Careless Backing Accidents

- Hazards of Backing
  - Difficult to Master
  - Accidents Will Be Avoided if You Are Careful
  - Don't Spoil a Good Record With One Careless Backing Accident
- Keep Safety in Mind
  - Walk Behind Vehicle and Check Before Backing
  - Check Clearances Above
  - Align Mirrors Properly
  - Use Helper
  - Sound Horn, Flash Lights When Required
  - Avoid Blind Side Backing



LESSON 2 DEVELOPMENT OF BACKING SKILLS (RANGE)

Overview

Time Allotted: 22 hours

Prerequisites: Unit 1.6, Lesson 1

Purpose

The purpose of this lesson is to develop the skills required for backing and parking maneuvers performed in a tractor-trailer vehicle. An assortment of backing and parking exercises are used to achieve the lesson purpose. Each student must receive a minimum of seven hours behind the wheel practicing the exercises. All exercises are demonstrated and explained by the instructor.

Materials

Instructional Aids

None

Student Material

Range safety rules, in Unit 1.1 of Student Manual

Instructor Material

Range Diagrams for Exercises 1 through 3 (at end of lesson)

Equipment

Tractor-trailer. Range equipment as shown on range diagrams.
One set of range exercise diagrams to be placed in cab of each tractor-trailer.

Content

Activity or Topic	Approximate Time
1. ALLEY DOCK: SIGHT SIDE	7 hours
2. JACKKNIFE PARK: SIGHT SIDE	7 hours 30 minutes
3. PARALLEL PARKING	7 hours 30 minutes
	22 hours

1. ALLEY DOCK: SIGHT SIDE (7 hours)

Purpose

The purpose of this exercise is to demonstrate and practice the alley dock backing maneuver.

Range Layout

See Range Diagram, Exercise #1

Directions

1. Divide students into groups of three. Assign each group to one instructor/vehicle.
2. Instructor demonstrates alley dock backing procedure (5 minutes).
3. Each student in turn completes the exercise (60 minutes total, 20 minutes per student).
4. Instructor walks by cab door during students initial practice to coach, correct and assist student.
5. Students not driving will observe.
6. At least 2 hours additional practice for each student should be scheduled (can occur during later range sessions).
7. Instructor supervises additional practice. Students will be evaluated during additional practice time.

Observation

The instructor will observe for failure to perform the following procedures properly:

Approach alley at right angle
Turn wheel to right when tractor passes center spot of alley
Stop with the rig in an arc so left rear corner of trailer and the intended "target" are visible--straighten steering wheel
Check clearance behind
Maintain path by proper "jacking" and "chasing"
Stop 10 feet from dock
Apply brakes and secure vehicle
Walk to dock to check remaining space (not needed with helpers)
Ease vehicle to dock

Evaluation

Student performance will be evaluated against the following criteria:

1. Does not hit any course markers or cross boundaries of problem
2. No more than three pullups permitted
3. Parks within 18" of the "dock"

2. JACKKNIFE PARK: SIGHT SIDE (7 hours 30 minutes)

Purpose

The purpose of this exercise is to demonstrate and practice the alley dock backing maneuver ending by being parked in the jackknife position.

Range Layout

See Range Diagram, Exercise 2.

Directions

1. Divide students into groups of three. Assign each group to one instructor/vehicle.
2. Instructor demonstrates alley dock backing procedure (5 minutes).
3. Each student in turn complete the exercise (90 minutes total, 30 minutes per student).
4. Instructor walks by cab door during students initial practice to coach, correct and assist student.
5. Students not driving will observe, reset barriers when necessary.
6. At least 2 hours additional practice for each student should be scheduled (can occur during later range sessions).
7. Instructor supervises additional practice. Students will be evaluated during additional practice time.

Observation

The instructor will observe for failure to perform the following procedures properly:

Position vehicle properly
Check clearance and behind
Maintain path by proper "jacking" and "chasing"

Turn steering wheel to right when rear wheels reach turning point (approximately midway point of alley)
The trailer backs in a line that will allow the tractor to follow (approximately at a 15° angle)
When trailer is about to make contact with dock, turn steering wheel sharply to the right to achieve a 90° jackknife position

Evaluation

Same as Exercise #1, except vehicle must end in jackknife position

3. PARALLEL PARKING (7 hours 30 minutes)

Purpose

The purpose of this exercise is to demonstrate and practice parallel parking.

Range Layout

See Range Diagram #3

Directions

1. Instructor demonstrates parallel parking (5 minutes).
2. Each student in turn completes the exercise (90 minutes total, 30 minutes per student).
3. Instructor walks by cab door during students initial practice to coach, correct and assist student.
4. Students not driving will observe, reset barriers when necessary.
5. At least 2 hours of additional practice for each student should be scheduled (can occur during later range sessions).

Observation

The instructor will observe for failure to perform the following procedures properly:

Position tractor-trailer properly
    Drive past front of parking space, paralled to it
    Stop when trailer is approximately three feet from end of space
Check area that is to be backed into
Turn steering wheel slightly to the left when vehicle starts backing
Trailer enters space at approximately 15° angle
Turn steering wheel sharply to the left when front of trailer is even with front of space
Continue backing until tractor-trailer is within parking space
Pull unit forward, adjust clearance evenly front and back

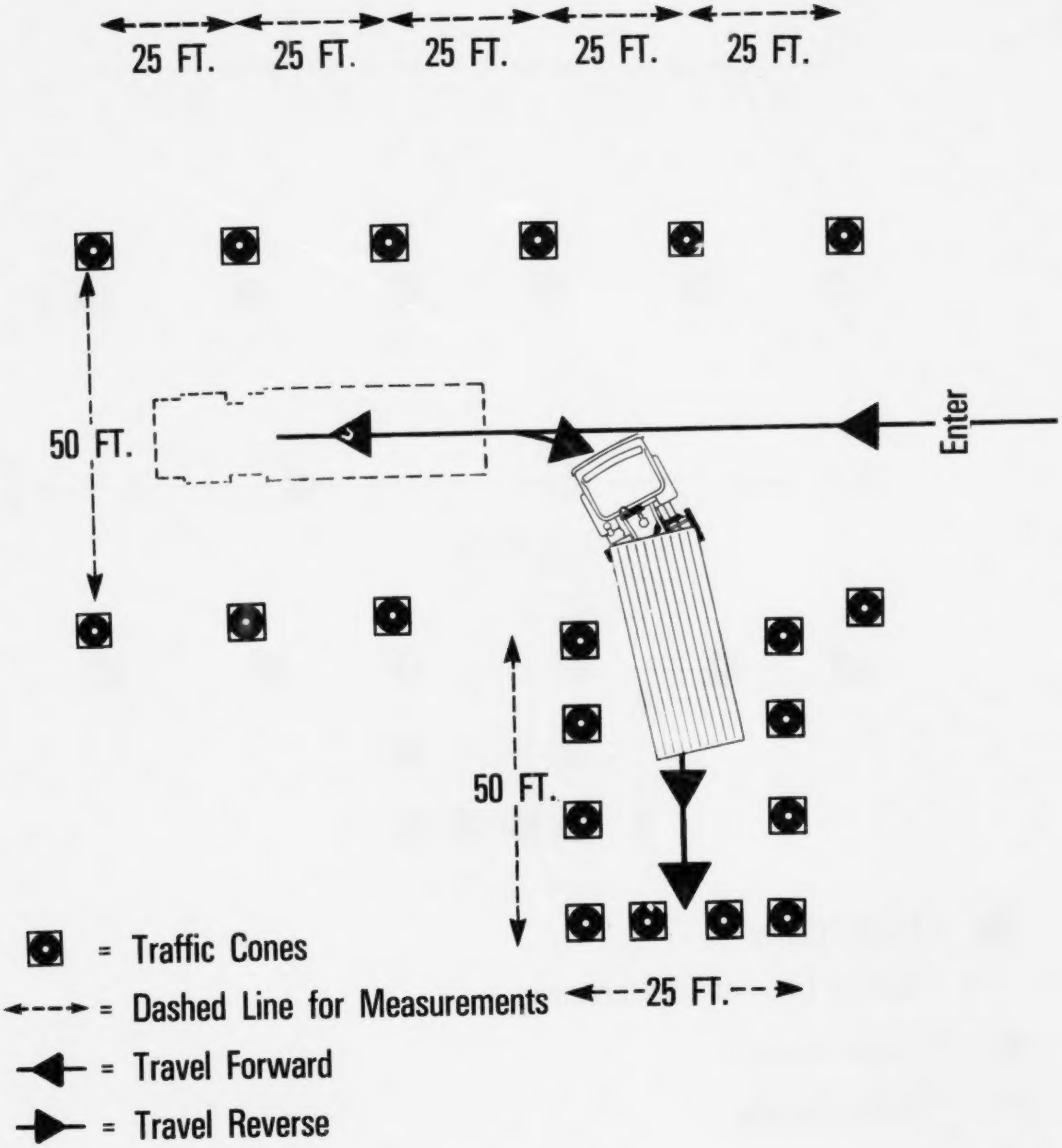
Evaluation

Student performance will be evaluated against the following criteria:

1. Does not hit any course markers or cross the boundaries of problem
2. No more than three pullups permitted
3. Parks 12" to 15" from curb

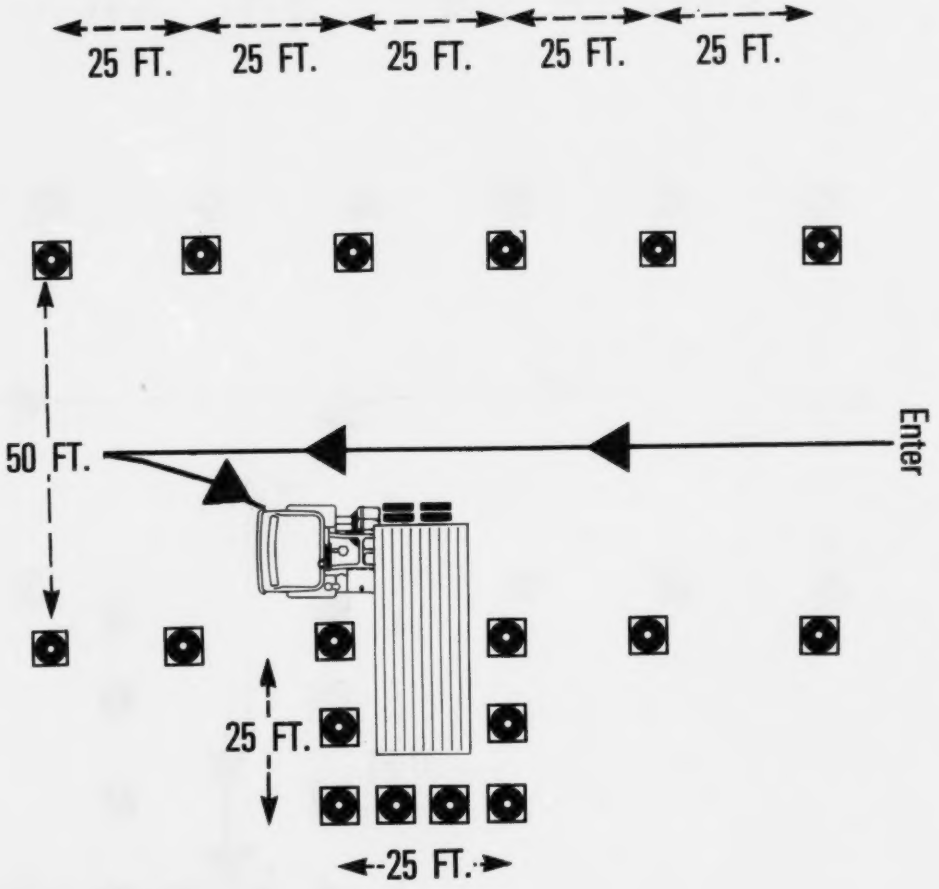
Range Diagram—Exercise 1

Alley Dock


25 FT.
25 FT.
25 FT.
25 FT.
25 FT.
Enter
50 FT.
50 FT.
25 FT.
= Traffic Cones
= Dashed Line for Measurements
= Travel Forward
= Travel Reverse

Range Diagram–Exercise 2

Jackknife Park


25 FT.
25 FT.
25 FT.
25 FT.
25 FT.
50 FT.
Enter
25 FT.
25 FT.

◙ = Traffic Cones

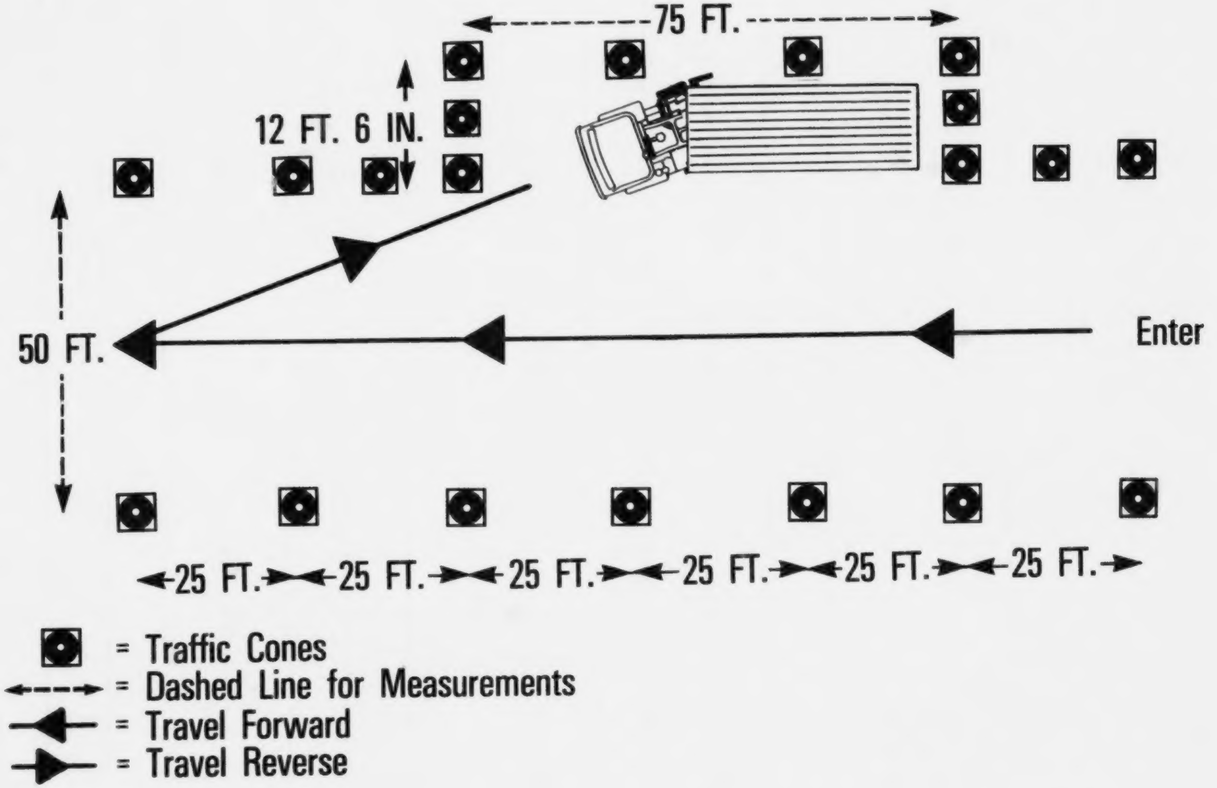
←---→ = Dashed Line for Measurements

—◀— = Travel Forward

—▶— = Travel Reverse

Range Diagram—Exercise 3

Parallel Park


75 FT.
12 FT. 6 IN.
50 FT.
Enter
25 FT.
25 FT.
25 FT.
25 FT.
25 FT.
25 FT.
= Traffic Cones
= Dashed Line for Measurements
= Travel Forward
= Travel Reverse

Notes:

UNIT 1.7
COUPLING AND UNCOUPLING

UNIT 1.7 COUPLING AND UNCOUPLING

PURPOSE

The purpose of this unit is to develop the skills necessary for safe coupling and uncoupling of tractor-trailer units.

OBJECTIVES

Performance Objectives: Coupling

Students must be able to

- align the tractor properly to connect with trailer.
- secure the trailer against movement.
- back the tractor properly into the trailer kingpin without damage.

Students must

- perform mechanical and visual checks to make sure coupling is secure.
- connect electrical and air lines properly.
- set in-cab air brake controls properly.
- retract and secure landing gear after coupling is secure.

Performance Objectives: Uncoupling

Students must

- select a surface capable of supporting the trailer and secure the vehicle against movement.
- set in-cab air brake controls properly.
- lower landing gear sufficiently to raise trailer to the proper height.
- disconnect air and electrical lines prior to uncoupling.
- check to make sure landing gear is supporting trailer as tractor is withdrawn.

Knowledge Objectives

Student must know

- the procedures for proper coupling and uncoupling.
- the hazards of improper coupling and uncoupling.

Skill Objectives

Students must be able to

- align the two units, tractor and trailer.
- back the trailer to achieve sufficient force to lock the fifth wheel and the kingpin without damaging the kingpin.
- pull against the pin to check the connection without abusing the tractor.

Attitude Objectives

Students must believe that

- careless coupling and uncoupling is very dangerous.
- the accidents caused by improper coupling and uncoupling are always preventable.

LESSONS

Lesson 1. Coupling and Uncoupling Procedures (Classroom) 45 minutes

Lesson 2. Coupling and Uncoupling Skills (Range) 3 hours 30 minutes

LESSON 1 COUPLING AND UNCOUPLING PROCEDURES (CLASSROOM)

Overview

Time Alloted: 45 minutes

Prerequisites: Unit 1.6

Purpose:

The purpose of this lesson is to present the step-by-step procedures of coupling and uncoupling tractor and trailer units. The importance of doing it "by the numbers" and the hazards involved are stressed. This lesson also prepares students for the range activity in Lesson 2.

Materials

Instructional Aids

Visuals 1-11

Student Material

No additional material required.

Instructor Material

No additional material required.

Content

Activity or Topic	Approximate Time
1. OVERVIEW OF COUPLING PROCEDURE	10 minutes
2. DETAILED STEP-BY-STEP PROCEDURES	15 minutes
3. UNCOUPLING PROCEDURES	15 minutes
4. SUMMARY OF SAFETY HAZARDS	5 minutes
5. COUPLING AND UNCOUPLING TWIN TRAILERS	(15 minutes)*
	45 minutes

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* Optional

1. OVERVIEW OF COUPLING PROCEDURE (10 minutes)

Requirements to Learn Procedure

Coupling/uncoupling skills basic to tractor-trailer operation
FMCSR requires operator be skillful in coupling/uncoupling units he will drive
Part of road test for driver

Importance of Following Step-by-Step Procedure

Must learn how to couple/uncouple "by the numbers", i.e., follow each step in exact sequence to avoid injury or damage to vehicles.

Performance When Skill Is Mastered

Experienced driver can couple tractor-trailer units safely in 5 minutes if weather conditions are right and all equipment is operating properly.

Performance When Skill Is Not Mastered

When driver does not know what he is doing, serious consequences can occur.

Trailer dropped with serious damage to trailer and contents
Air and electrical damaged or torn off
Landing gear damaged or driven through trailer floor when trailer dropped
Tractor or trailer rolling into people or property
Tractor cab damaged from trailer "jumping the pin"

Consequences to driver
- Crushed by rolling tractor wheels
- Injured from slamming tractor against a trailer that is too high or too low for proper hookup
- Crushed from falling trailer as the landing gear collapses

Visual 1 List of Basic Steps in Coupling

Overview of Basic Coupling Procedure

NOTE: Present general steps of coupling procedure to give students an overview. Then present detailed steps which include reasons and safety hazards involved.

Step 1. Inspect fifth wheel for damage and to see if in position to be coupled, i.e., tilted down towards rear of tractor.

Step 2. Position tractor directly in front of trailer.

Step 3. Back slowly until the jaws of the fifth wheel barely touch pickup apron of trailer.

Step 4. Secure tractor and get out of cab.

Step 5. Inspect area for obstacles and chock trailer wheels.

Step 6. Inspect trailer height and adjust if too high or too low.

Step 7. Connect airlines between the tractor and trailer.

Step 8. Get back in cab and air the trailer.

Step 9. Apply trailer brakes.

Step 10. Back tractor until fifth wheel engages kingpin and locks.

Step 11. Pull gently forward to test connection.

Step 12. Repeat Step 11.

Step 13. Secure tractor against rolling.

Step 14. Get out and inspect coupling.

Step 15. Connect electrical cable to trailer.

Step 16. Raise and secure trailer landing gear.

Step 17. Remove trailer wheel chocks.

2. DETAILED STEP-BY-STEP PROCEDURES (15 minutes)

Visual 2 Fifth Wheel Assembly

Fifth Wheel Assembly

Two Basic Types

- Fixed mounts
- Sliders
  - Manual sliders, single or double locked
  - Air-activated locks

Key Parts to Fifth Wheel Assembly

- Coupler arm
- Safety release handle
  - Pulled out before coupling
  - Automatically comes to "in" position when coupled/locked
  - Safety catch goes down over handle to prevent unintended release

NOTE: Present information about locking mechanisms on fifth wheels used on your vehicles.

- Locking jaws
  - Enclose trailer kingpin
  - Close as fifth wheel strikes coupler arm

Visual 3 Tractor in Position to Couple with Trailer

Step 1. Inspect Fifth Wheel

- Check for damaged/missing parts
- Check mounting to tractor--secure, no cracks in frame, etc.
- Check for proper lubrication
- Check if fifth wheel in proper position for coupling
  - Wheel tilted down towards rear of tractor
  - Jaws open
  - Safety release handle in the automatic lock position

Step 2. Inspect Area and Chock Wheels

- Make sure area clear of obstacles, spectators
- Be sure trailer wheels chocked or trailer backed to front of loading dock
- Check cargo (if any) is secured against movement of tractor coupling to trailer
- Chock trailer wheels on left side
  - Chocks in front of wheels
  - Chocks in back of wheels
- If trailer is backed against a loading dock only a chock in front of wheels is necessary
- When trailer is equipped with spring loaded brakes it is still necessary to chock the wheels to prevent trailer movement

Step 3. Position Tractor

- Position tractor squarely in front of the trailer--Never back under trailer at an angle
  - Use left mirror
  - Line up outside edge of left rear outer dual wheel (tire) with the outer edge of trailer
  - Check alignment by sighting down side of the trailer--not by looking at the corner
  - Check both mirrors again to determine that the tractor and trailer are accurately aligned
- Importance of proper alignment
  - Improper approach can push trailer backwards or sideways
  - Landing gear are fragile and may break

Step 4. Back Slowly

- Back until jaws just touch pickup apron of trailer
- Don't jar the trailer

Step 5. Secure Tractor

- Shut down engine
- Put transmission in low gear
- Apply parking brake
- Leave cab

Visual 4 Proper Alignment Between Fifth Wheel and Trailer Apron

Step 6. Check Trailer Height

- Make visual inspection of alignment of tractor fifth wheel with trailer kingpin
    - Trailer should be very slightly lower than fifth wheel
- Adjust trailer height if needed by cranking trailer supports up or down If trailer too low, tractor may strike and damage nose of trailer
    - If trailer too high, it may ride up over fifth wheel and into rear of cab
- Check that kingpin and fifth wheel are aligned
- Never go under nose of trailer unless it is supported by tractor
    - Landing gear could collapse
    - Driver could be crushed

Visual 5 Connection of Air Lines

Step 7. Connect Air Lines to Trailer

- Need to connect air lines to be able to use trailer brakes
- Connect tractor emergency air line to trailer emergency glad hand
- Connect tractor service air line to trailer emergency glad hand
- Check that washers (rubber grommets) in all 4 glad hands are not damaged and are properly "seated" to prevent air leaks
- **Caution:** make sure to connect emergency to emergency and service to service line
    - Some are colored-coded, i.e., service is blue and emergency is red
    - Some use different shape glad hand heads--service is square and emergency is round
    - Some will connect only one way therefore never try to force glad hands to connect with each other
    - Some not coded or identified
        - Must use trial-and-error method to prevent "crossed lines"
- Use caution when connecting air lines
    - Many falls have occurred and driver ended up straddling drive shaft
    - Be aware of greasy rails when connecting lines
    - Make sure shoes aren't greasy or slippery
    - Hands on and look where stepping
- Do not connect electrical cable at this time
    - If vehicle rolls away, cable could be ripped
    - Costly and time consuming to trouble shoot and repair electrical wiring

NOTE: Some fleets teach their drivers not to connect the air lines at this time. While the danger of air lines being ripped is a factor, the safety benefits of using trailer brakes are greater than the danger. Remind students, however, to follow their employer's procedures which supersede those taught in school.

Make sure air lines are safely supported where they won't be crushed or caught while tractor is backing under the trailer

Visual 6 Coupling of Tractor Trailer

Step 8. Supply Air to Trailer

Get back into cab
Move tractor protection valve from the "Emergency" to the "Normal" position to supply trailer brake system with air
Apply trailer brake
Check brake system for crossed air lines
    Listen for application and release of trailer brakes while applying/releasing independent trailer brake valve
    Trailer brake response should be rapid and positive, i.e., should hear slack adjustors move and air escape from quick release valves
    Check air brake system pressure gauge for signs of excessive air loss
When sure trailer brakes are working, restart engine
    Make sure pressure is back up to normal pressure again prior to moving the tractor

Step 9. Apply Trailer Brakes

Apply trailer brake in preparation for backing tractor underneath trailer
If trailer has spring brakes, use of trailer brake is not necessary
Good idea to use trailer brake anyway
    Can't always determine condition of spring brakes
        May not be in good operating condition
        Sometimes deliberately made inoperable (i.e., "caged") for easy moving around yard

Step 10. Back Under Trailer

Use lowest reverse gear
Back tractor slowly under trailer to
    avoid hitting the kingpin too hard
Can result in
    bending the pin
    jumping the pin
    pushing the trailer away
    damaging the cargo in trailer
As tractor squats from trailer weight: be prepared for tractor to jump forward
    Brake fast to keep air lines from being torn off
Stop when fifth wheel engages kingpin
    Will feel and hear it engage
    Disengage clutch immediately to prevent damage

Visual 7 Inspect Coupling

Step 11. Check Connection for Security

Pull tractor **gently** forward against locked trailer brakes and/or chocked wheels to check kingpin alignment
Quickly disengage clutch as soon as resistance is felt to forward motion
Don't accelerate engine more than is required to keep engine from stalling while pulling against the pin

Step 12. Recheck the Coupling

Repeat Step 11 one more time, to see if the kingpin remains engaged and/or locked
Release trailer brake

Step 13. Secure Vehicle

Put transmission in low gear
Shut down engine
Apply tractor parking brake
Leave cab

Step 14. Visually Inspect Coupling

- Use a flashlight
- Go under trailer
- Look to see if the fifth wheel jaws have engaged the head instead of the shank of the kingpin
- If jaws are closed around head
  - Trailer will bounce the kingpin out of the fifth wheel jaws
  - Trailer will be lost
- Look for any space between upper and lower fifth wheel
  - If there is space, something is wrong
  - Stop and find out before doing anything else
- Check that locking lever has moved to the "Lock" position
  - If it hasn't, something is wrong
  - Stop and find out before you do anything else
- Check that safety catch is in position over locking lever
  - Necessary to preclude the accidental opening of the fifth wheel lock release
- On some fifth wheels the catch must be manually put in place

Visual 8 Example of Electrical Plyg

Step 15. Connect the Electrical Cable

- Make connection properly
  - Match plug to connector
  - If it doesn't fit, don't force it
- Make sure plug compatible with trailer connector
  - 4 and 6 prong types
  - Tractor and trailer may have different connectors
    - Obtain and use a convertor
    - Do not makeshift

After plug is firmly seated in the receptacle
    Engage safety catch or latch
    Necessary to prevent accidental dislodgement of the plug due to vibration
Double check both air lines and electrical line for signs of defects/damage likely to cause failure
Make sure air and electrical lines are properly secured
    Use hose tenders (sometimes called pogo sticks)
    Prevents rubbing, chafing, or snagging by moving parts of vehicle

Visual 9 Landing Gear

Step 16. Raise Front Trailer Supports (Landing Gear)

Use low gear range (if so equipped) to commence raising the landing gear
Once free of weight, switch to the high gear range
Continue cranking until landing gear is fully raised
Never operate with landing gear only partially raised as they will catch on railroad tracks or dip in road, etc.
After raising landing gear, make sure crank handle is safely secured in bracket--if left loose it could swing out due to centrifugal force on turns
    Cause serious injury to passing pedestrians
    Snag on vehicles and objects
When full weight of trailer is resting on tractor
    Check to make sure adequate clearance between top of the tractor drive wheels (tires) and the nose of the trailer
    If trailer rubs the drive wheels during a high speed turn it could cause loss of vehicle control
Check to make sure that there is adequate clearance between rear of tractor frame and landing gear
    Must accommodate swing (arc) of tractor frame on sharp turns
    Especially important to check on a tandem axle tractor and/or a sliding fifth wheel

Step 17. Remove Trailer Wheel Chocks

Remove and stow wheel chocks in safe place
Completes the coupling procedure
Ready to complete the "trailer only" portion of a pretrip inspection

3. UNCOUPLING PROCEDURES (15 minutes)

Visual 10 Steps in Uncoupling

Overview of Basic Uncoupling Procedure

NOTE: Briefly present the uncoupling procedure to give students an overview. Then present detailed steps which include reasons and safety hazards involved.

Step 1. Position vehicle

Step 2. Apply trailer brake

Step 3. Place tractor protection valve in EMERGENCY position

Step 4. Secure rig

Step 5. Lower landing gears

Step 6. Disconnect and store air lines and electrical cable

Step 7. Release fifth wheel latch

Step 8. Pull tractor partially clear of trailer

Step 9. Secure tractor

Step 10. Check trailer supports

Step 11. Pull tractor completely clear of trailer

Step 1. Position Rig

Make sure surface can support trailer

- Trailer can "sink" into hot blacktop, loose dirt, stones, spongy blacktop
- Avoid surfaces which cannot support trailer
- If firm surface unavailable:
  - Use trailer support plates--2-foot square steel plates, under the landing gear legs
  - Use 2 x 6 boards if trailer support plates unavailable
  - Lay long ways

Position tractor directly in line with trailer to avoid damage to landing gear when pulling tractor from under trailer

Step 2. Apply Trailer Brake

Ease pressure on kingpin

- Back up gently
- Aids release of kingpin lock lever

Step 3. Place Tractor Protection Valve in "Emergency" Position

This cuts off air between tractor and trailer
Prepares air lines to be disconnected

Step 4. Secure Rig

Apply tractor parking brake
Place transmission in low gear
Shut down engine
Chock rear trailer wheels

Step 5. Lower Landing Gear

Trailer empty--lower supports to firm contact with ground
Trailer loaded--turn crank in low gear a few extra turns
    Lifts some weight off the tractor
        To make it easier to unlatch fifth wheel
        To make it easier to couple next time

Step 6. Disconnect Air Lines and Electrical Cable

Place air line glad hands on dummy couplers at back of cab
Electrical cable is hung down to avoid moisture
Secure lines against snagging, abrasion, damage

Step 7. Release Fifth Wheel Latch

Release latch
    Raise release handle lock pin
    Pull the release handle to "open" position

If handle will not move
    Too much pressure on fifth wheel
    Get in cab
    Release tractor parking brake
    Back tractor gently to release pressure
    Secure tractor
    Get out and release latch to "open" position

Use of pull handle or hook
    Single axle tractor--usually no difficulty in pulling release hatch
    Tandem axles--sometimes cannot reach release catch
        Pull handle or hook is used to reach it

Watch out for tractor being pushed forward
    When fifth wheel latch released, trailer could "push" tractor forward
    Keep legs and feet clear of wheels to avoid serious injury

Step 8. Pull Tractor Partially Clear of Trailer

Return to cab
Start engine and release parking brake
Pull tractor forward until fifth wheel begins to clear trailer apron plate
Stop tractor with frame under trailer
Prevents trailer from falling to ground if landing gear collapse or sink

Step 9. Secure Tractor

Same as Step 4

Step 10. Inspect Trailer Supports

Make sure ground is supporting trailer
Make sure gear is not damaged
If necessary, support unit until repairs are made
    Recouple unit
    Use trailer safety jack under the nose of the trailer

Step 11. Pull Tractor Clear of Trailer

Start engine and release parking brakes
Check the area and drive tractor clear
Uncoupling is safely completed

4. SUMMARY OF SAFETY HAZARDS (5 minutes)

Visual 11 List of Coupling Hazards

Coupling and Uncoupling Hazards

Coupling and Uncoupling Can be Dangerous

- Procedures should always be followed step by step in correct order
- If there is any doubt a checklist should be carried by the driver

Hazards to Vehicle

- Tractor not secured
  - Forward roll of tractor after air lines have been connected to trailer
  - Damage to air brake system of both tractor and trailer
- Trailer brakes not set when tractor is backed under the trailer (coupling procedure)
  - Tractor could possibly push trailer into an obstruction or could cause the landing gear to collapse
- Jaws of fifth wheel not securely fastened around kingpin
  - Trailer could break loose from tractor and cause damage to trailer, its cargo, another vehicle or person
- Ground not firm enough to support trailer when uncoupling
  - Trailer could fall, damaging trailer, its cargo and anybody or anything in its way
  - Trailer wheels not properly chocked
    - Tractor could push trailer or trailer could roll on its own into an obstruction (loading dock, another tractor-trailer, person, etc.) tearing off landing gear with trailer crashing to ground

Hazards to Driver

Climbing on tractor (connecting/disconnecting air lines, etc.)
- Make sure vehicle is secure
- Be alert to slippery, greasy surfaces
- Make sure your shoes are not slippery
- Do not jump off vehicle

Working under unsecured trailer
- Never get under disconnected trailer
- Do not go under trailer unless it is chocked
- Remove keys from ignition so no one will attempt to drive tractor away

Information about Range Exercise

Instructions

Describe range exercise for coupling and uncoupling and subsequent student practice

Instructor will demonstrate coupling and uncoupling

Students will perform in teams of three
- One student performs complete coupling and uncoupling
- One student gives directions from the checklist
- One student observes and corrects errors

Students rotate positions after each uncoupling

5. COUPLING AND UNCOUPLING TWIN TRAILERS (15 minutes)

NOTE: If a twin trailer combination is part of the school's training fleet, the following section should be covered as part of coupling and uncoupling procedures lesson.

Coupling

Couple tractor and first semi-trailer in manner described earlier.

Caution: For safe handling, heavier loaded semi-trailers must always be in first position--lighter trailer in 2nd (rear) position

Drain air from converter gear brakes
Chock wheels of second trailer

Moving Converter Gear

If distance is not too great, move converter gear manually
Use tractor and number one semi-trailer to pick up converter gear if distance is too far to move manually
- Position combination as close as possible to converter gear

- Complete hookup manually
  - Lock pintle hook
  - Secure converter gear support in raised position
  - If converter gear has to be moved on the road, hook up brakes, lights and safety chains
- Move converter gear into position as close as possible to nose of the number two semi-trailer
- Lower converter gear support
- Unhook converter gear

Connect Converter Gear to Front Trailer

- Align converter gear in front of rear trailer
  - Keep as straight as possible
- Back number one semi-trailer into position in front of converter gear tongue
- Complete hook up manually
- Lock pintle hook
- Secure converter gear support in raised position

Connect Converter Gear to Rear Trailer

- Back converter gear under rear trailer
- Test coupling by pulling against pin of number two semi-trailer
- Make visual check of coupling
- Connect safety chains, air hoses and light cords
- Close converter converter gear air reservoir petcock

Uncoupling

Uncouple Rear Trailer

- Park rig in a straight line on firm level ground
- Set tractor parking brake, shut down engine--put into low gear, etc.
- Set tractor protection valve in emergency position
- Chock 2nd semi-trailer wheels
- Lower landing gear of 2nd semi-trailer enough to remove some weight
- Close air shutoffs at rear of first semi-trailer or on converter (if so equipped)
- Secure air and electric lines so they don't become entangled or damaged
- Hook glad hands together or fasten to dummy hookups if available
- Release converter gear fifth wheel latch
- Bleed converter gear air tank, if necessary, to release converter gear brakes
- Slowly pull tractor, first semi-trailer and converter gear out from under rear semi-trailer

Uncouple Converter Gear

Lower converter gear landing gear
Disconnect brake lines, electric lines and safety chains and secure
Close air shutoff valve at rear of first trailer
Apply converter gear spring brakes or chock wheels
Release pintle hook on first semi-trailer
Slowly pull clear of converter gear
Manually move converter gear to final parking position

Caution: Never uncouple the number two semi-trailer with converter gear not attached, as tow bar may raise up too high to be able to recouple it lead trailer

Visual 1

List of Basic Steps in Coupling

Step 1. Inspect Fifth Wheel for Damage and to See if in Position to Be Coupled, i.e., Titled Down Towards Rear of Tractor

Step 2. Position Tractor Directly in Front of Trailer

Step 3. Back Slowly Until the Jaws of the Fifth Wheel Touch Pickup Apron of Trailer

Step 4. Secure Tractor and Get Out of Cab

Step 5. Inspect Area for Obstacles and Chock Trailer Wheels

Step 6. Inspect Trailer Height and Adjust if Too High or Too Low

Step 7. Connect Airlines Between the Tractor and Trailer

Step 8. Get Back in Cab and Air the Trailer

Step 9. Apply Trailer Brakes

Step 10. Back Tractor Until Fifth Wheel Engages Kingpin and Locks

Step 11. Pull Gently Forward to Test Connection

Step 12. Repeat Step 11

Step 13. Secure Tractor Against Rolling

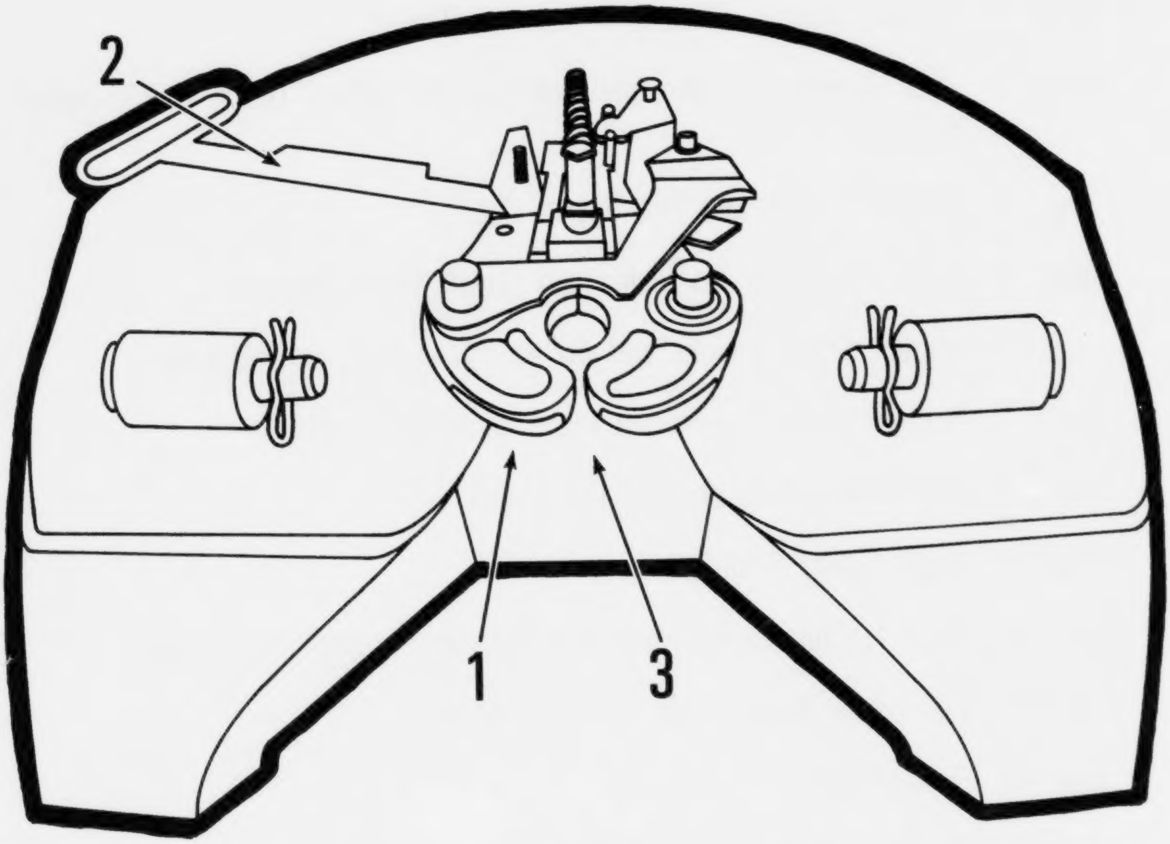
Step 14. Get Out and Inspect Coupling

Step 15. Connect Electrical Cable to Trailer

Step 16. Raise and Secure Trailer Landing Gear

Step 17. Remove Trailer Chocks

Blowup of Fifth Wheel Components

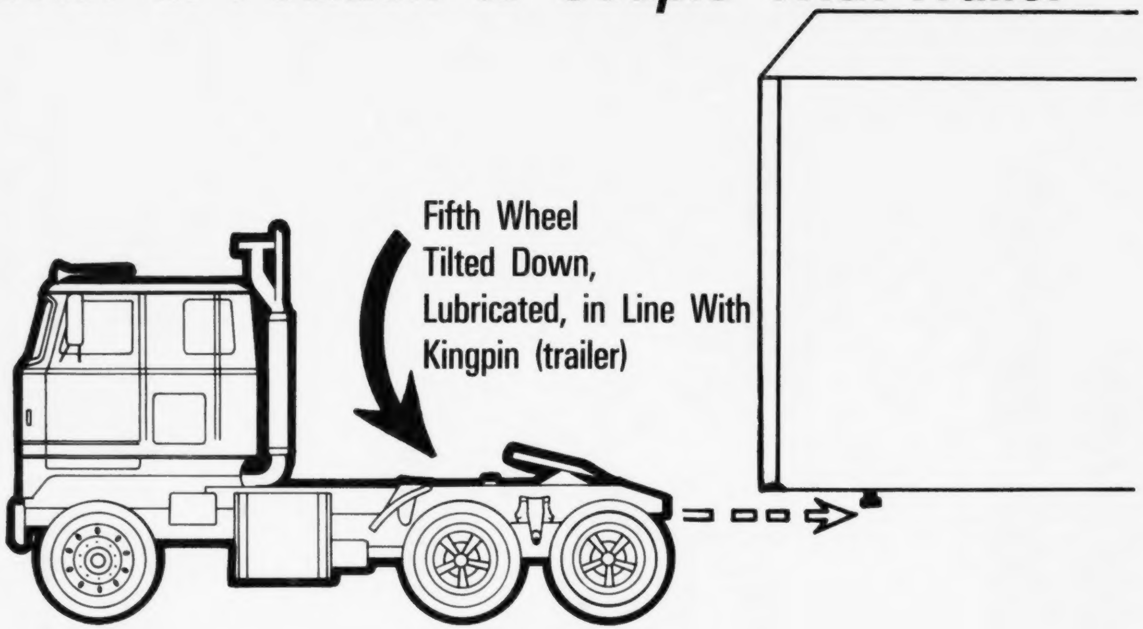


1. Coupler Arm

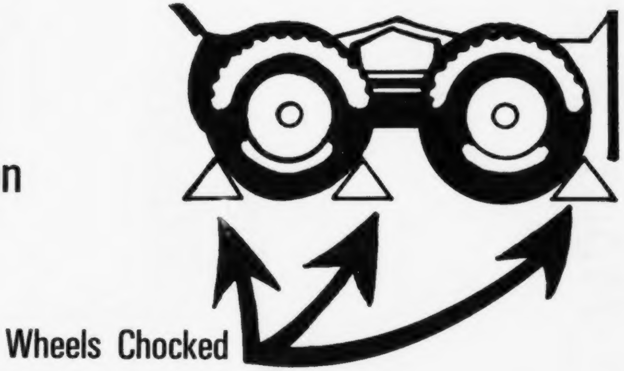
2. Release Handle

3. Locking Jaws

Tractor in Position to Couple With Trailer


Fifth Wheel
Tilted Down,
Lubricated, in Line With
Kingpin (trailer)

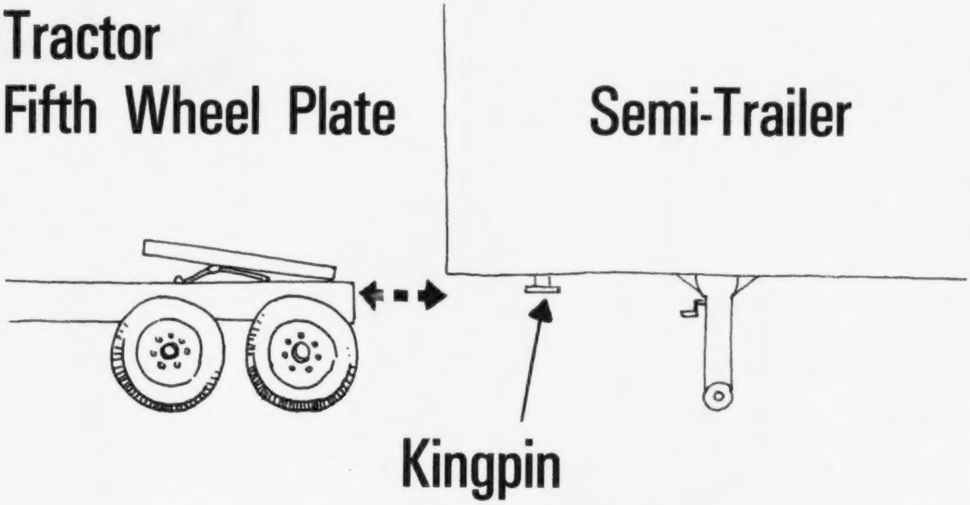
- Inspect Fifth Wheel
- Position Tractor
- Back Slowly Till Jaws Touch Pickup Apron
- Secure the Tractor
- Inspect Tires and Check Trailer Wheels

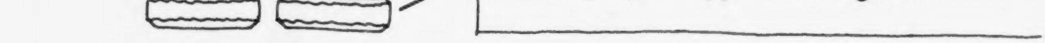

Wheels Chocked

Visual 4

Proper Alignment Between Fifth Wheel and Trailer

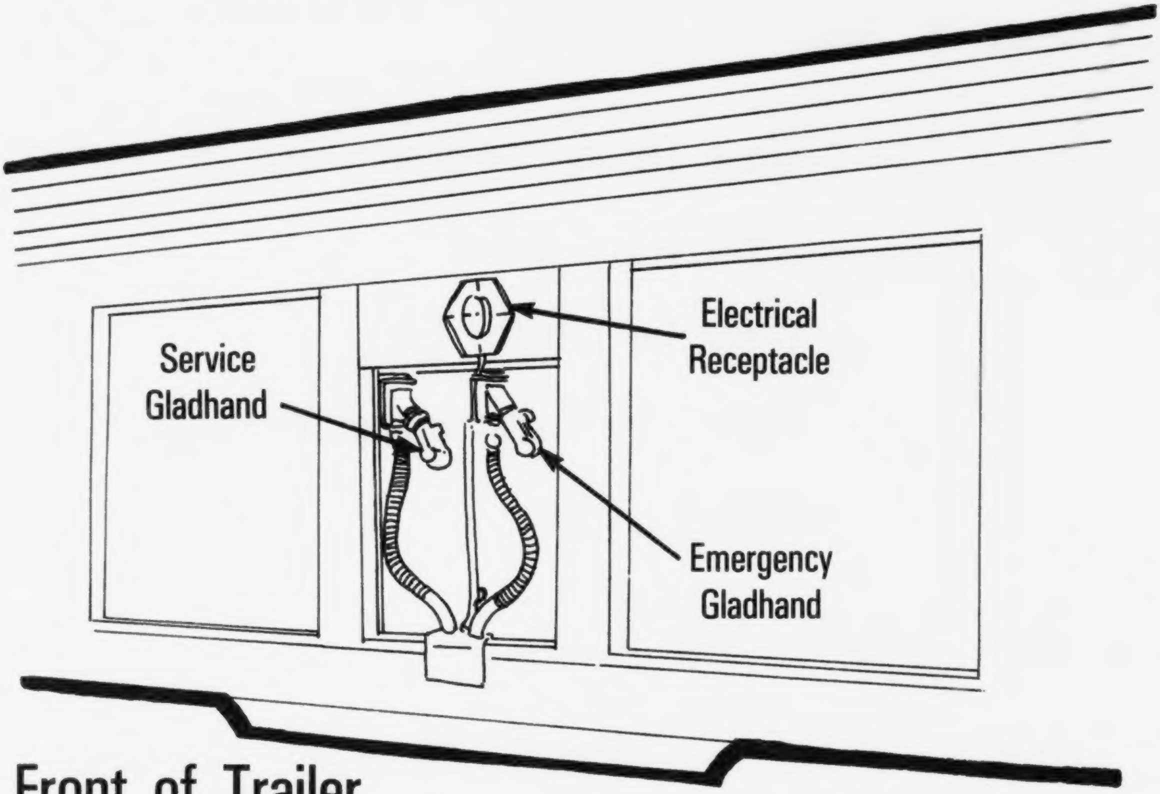
Step 6. Check Trailer Height


Tractor
Fifth Wheel Plate
Semi-Trailer
Kingpin


Semi-Trailer

Dotted Line Shows Proper Approach. Solid Lines Show Improper Approach Angles.

Connect Air Lines to Trailer


Service Gladhand
Electrical Receptacle
Emergency Gladhand

Front of Trailer

Step 7.
- Connect Air Lines
  - – Emergency to Emergency
  - – Service to Service
    - Color Coded
    - Shape Coded
    - No Coding
- Use Caution for Slippery Surfaces
- Make Sure Air Lines Have Enough Slack

Coupling of Tractor-Trailer

Step 8. Supply Air to Trailer

- Move Tractor Protection Valve to "Normal"
- Apply Trailer Brake
- Check for Crossed Lines
- Make Sure Trailer Brakes Working
- Restart Engine

Step 9. Apply Trailer Brakes

Step 10. Back Under Trailer Slowly to Avoid Damage

Be Ready in Case Tractor Jumps Forward

Stop When 5th Wheel Engages Kingpin

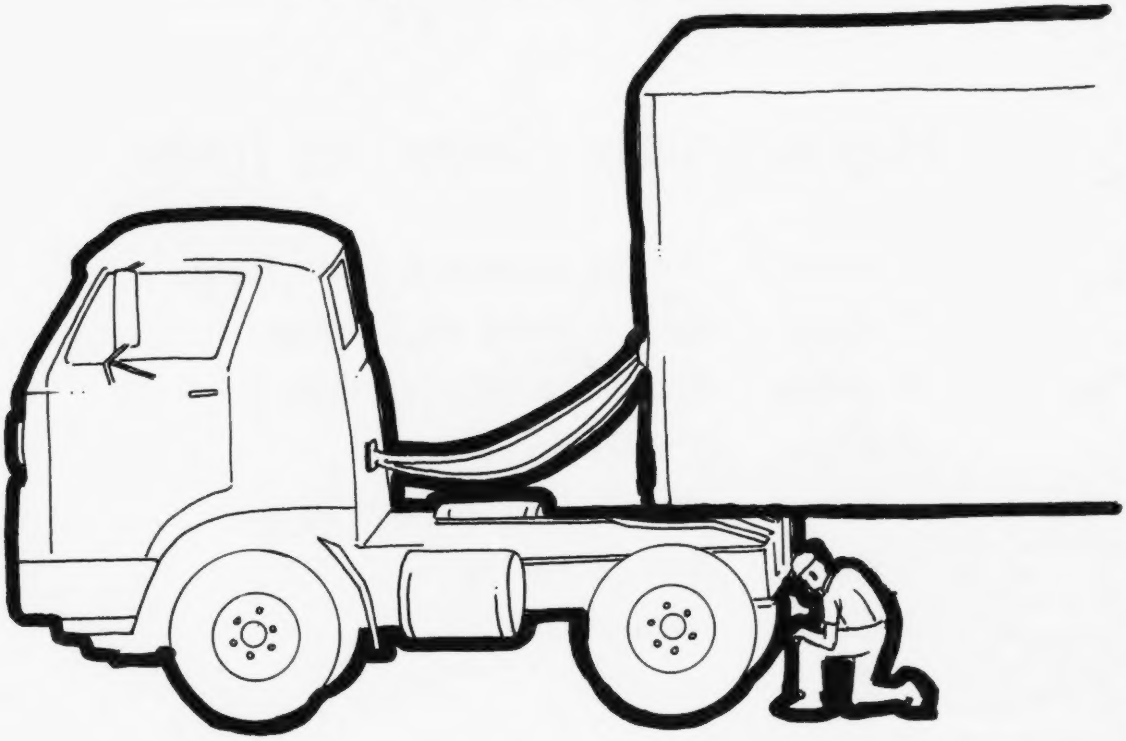
Inspect Coupling

Step 11. Check Connection for Security
Pull Tractor Gently Forward

Step 12. Repeat Step 11

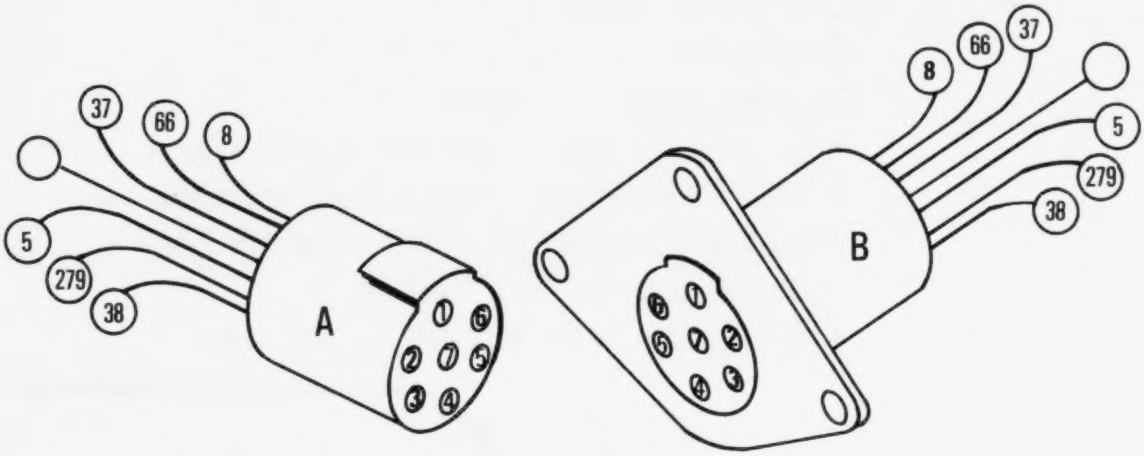
Step 13. Secure Tractor

Step 14. Visually Inspect Coupling
- Use Flashlight
- Get Under Trailer and Check if –
  - 5th Wheel Engaged Shank Not Head of Kingpin
  - Jaws Closed Properly Around Shank of Kingpin
  - No Space Between Upper and Lower 5th Wheel
  - Locking Lever in "Lock" Position
  - Safety Catch in Position Over Locking Lever



Visual 8

Example of Electrical Plugs


37
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7

Plug on Tractor Socket on Trailer

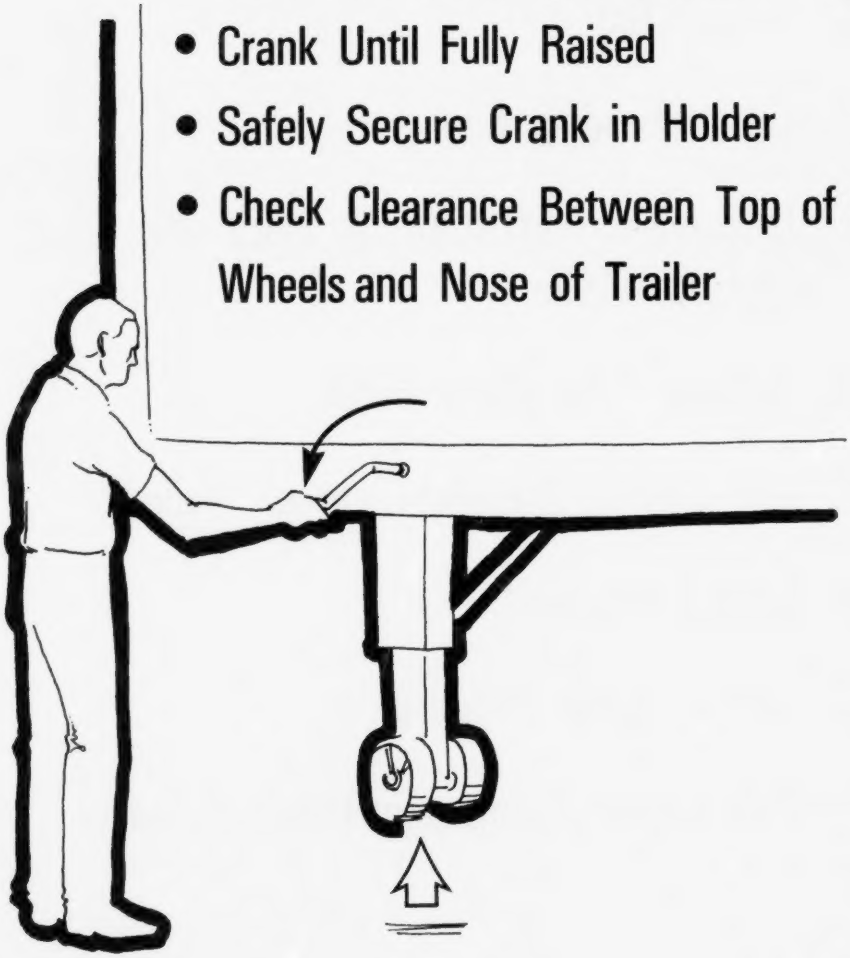
1 (White)	Wire 66:	Grounded to Tractor Frame
2 (Black)	Wire 5:	Marker and Clearance
3 (Yellow)	Wire 38:	Left-hand Turn Signal
4 (Red)	Wire 279:	Stop Light
5 (Green)	Wire 37:	Right-hand Turn Signal
6 (Brown)	Wire 8:	Tail Light
7 (Blue)	Auxiliary	Line

Visual 9

Landing Gear

Raise Front Trailer Supports (Landing Gear)

- Check Clearance Between Rear of Tractor Frame and Landing Gear
- Use Low Range to Begin Raising Landing Gear
- Once Free of Weight, Switch to High Gear
- Crank Until Fully Raised
- Safely Secure Crank in Holder
- Check Clearance Between Top of Tractor Drive Wheels and Nose of Trailer



Steps in Uncoupling

Step 1. Position Vehicle

Step 2. Apply Trailer Brake

Step 3. Place Tractor Protection Valve in EMERGENCY Position

Step 4. Secure Rig

Step 5. Lower Landing Gear

Step 6. Disconnect and Store Air Lines and Electrical Cable

Step 7. Release Fifth Wheel Latch

Step 8. Pull Tractor Partially Clear of Trailer

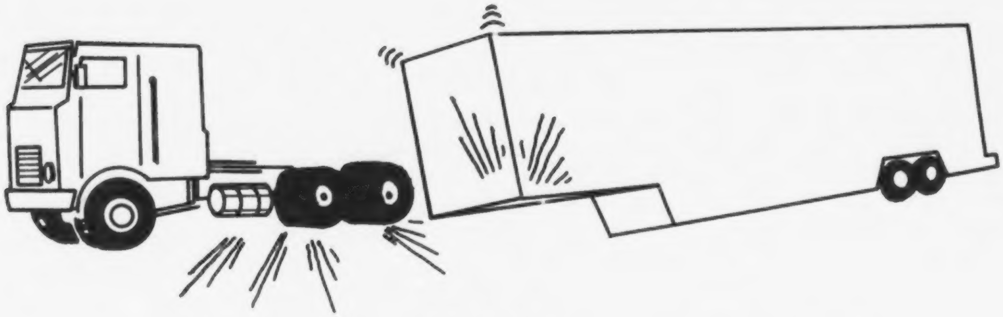
Step 9. Secure Tractor

Step 10. Check Trailer Supports

Step 11. Pull Tractor Completely Clear of Trailer

Visual 11

Coupling and Uncoupling Hazards



Vehicle

Hazard	Result
Tractor Not Secured	Damage to Brake Lines
Trailer Brakes Not Functioning	Trailer Pushed Into Obstruction
Jaws Not Securely Fastened	Trailer Breaks Loose on the Road
Ground Not Firm for Uncoupling	Trailer Falls and Is Damaged
Trailer Not Chocked	Pushed or Rolls Into Obstruction

Driver

Hazard	Result
Climbing on Tractor	Falls From Slippery Surface
Working Under Unsupported Trailer (No Jackstand or Tractor Under Trailer Nose)	Injury When Landing Gear Collapses and Trailer Drops to the Ground

LESSON 2 COUPLING AND UNCOUPLING SKILLS (RANGE)

Overview

Time Allotted: 3 hours 30 minutes

Prerequisites: Unit 1.7, Lesson 1

Purpose:

The purpose of this lesson is to develop student ability to eprform the step-by-step coupling and uncoupling procedures as taught in the classroom, in order to maximize safety and efficiency of these tasks. Following a commentary type demonstration by an instructor, students will each receive a minimum of 1-hour of BTW time in coupling and uncoupling a tractor-trailer. Following the initial practice received in this lesson, students must have additional practice to gain sufficient proficiency necessary to pass the Pre-Street Range Test and later on, the Final Examination Test Battery. The most efficient way to give students this additional practice is to uncouple rigs at the end of each range or street lesson and then couple them again at the start of a new lesson from this point on, throughout the course, up until the point in time that all students have attained required proficiency levels. Some students will require more time than others, thus slow learners should be given the majority of the coupling/uncoupling assignments, once other students have reached required skill levels.

Materials

Instructional Aids

None

Student Material

Range Safety Rules, in Unit 1.1 of Student Manual

Coupling Procedures Checklist, in Unit 1.7 of Student Manual

Uncoupling Procedures Checklist, in Unit 1.7 of Student Manual

Instructor Material

Coupling Procedures Checklist (at end of lesson)

Uncoupling Procedures Checklist (at end of lesson)

Equipment

Tractor-Trailer for each team of 3 studetns

Wiping rags and flashlight for each tem performing the exercise

Content

Activity or Topic	Approximate Time
1. COUPLING AND UNCOUPLING: DEMONSTRATION AND PRACTICE	3 hours 30 minutes
2. COUPLING AND UNCOUPLING: PROFICIENCY DEVELOPMENT	*

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* Amount of time required depends upon student progress

1. COUPLING AND UNCOUPLING: DEMONSTRATION AND PRACTICE (3 hours 30 minutes)

Purpose

The purpose of this exercise is to demonstrate coupling and uncoupling procedures to students and then to have them practice the procedures.

Range Layout

When practice occurs with several units on the range, vehicles should be spread out side-by-side with at least 25 feet on all sides to allow enough room.

Directions

1. Three students to one vehicle/instructor ration.
2. Instructor will conduct a commentary demonstration of uncoupling and then coupling a tractor-trailer, using the Coupling and Uncoupling Checklists as a guide (30 minutes). In carrying out the demonstration, the instructor will describe:

   Each step of the procedure as it is being performed

   What he/she is checking and why

   The possible consequences of failing to follow the procedure

   How to recognize a

      Properly functioning component
      Component that is in iminent danger of failing or malfunctioning
      Component that has already failed or malfunctioned or is missing

      What characteristics of the vehicle and/or component that the instructor is seeing, feeling, sensing and his/her analysis thereof

3. Students observe and follow along using their copy of the Coupling and Uncoupling Checklists and should ask questions if at any time they do not understand what the instructor is doing or why he/she is doing it and make notes on checklsits regarding critical items or technical points.

4. Each student in turn completes the coupling and uncoupling procedure (60 minutes, total of 20 minutes per student).

5. Instructor walks by the cab door during student's initial practice to coach, correct and assist student.

6. Students not driving will observe.

7. At least 40 minutes of additional practice for each student must then take place.

8. Instructor closely supervises this additional practice and evaluates student performance.

Instructor Supervision

The instructor should supervise, coach and observe student practice to assure that it is done safely and correctly and to give the feedback required in the learning process

- Answers students' questions when the student has difficulty performing any of the steps in the procedure
- When necessary, the instructor will assist a student or again explain and/or demonstrate the part of the procedure which is causing the difficulty
- Stops the practice before the student does anything which would endanger his/her safety or the safety of anyone or the vehicle
- Assures that each student describes what he/she is doing each step of the way; if the student describes what he/she is doing and sees, the instructor will have a better gauge to measure the student's understanding of the procedure

Observation

The instructor will observe students for their ability to safely and correctly perform the coupling and uncoupling procedures that are outlined on the checklists appearing at the end of this lesson. During the initial practice, each student will have the aid of their checklists, fellow students and instructor coaching. These aids, however, do not ensure safe and correct performance. The instructor should look for and correct the following errors.

Coupling

Maneuvering the Vehicle

- Does not properly align the tractor and trailer causing excessive steps and direction changes when backing or resulting in tractor backing at an angle
- Is not able to keep the vehicle on its path when backing and making excessive stops and direction changes or pullups from the trailer because the fifth wheel and kingpin are not in line
- Backs at an excessive speed
- Accelerates more than required while pulling tractor against pin to check connection

Inspecting Vehicle Components

- Not able to recognize if fifth wheel is in position and ready for coupling
- Not able to judge if trailer height needs adjusting prior to coupling
- Not able to recognize when coupling is safely completed, i.e., jaws locked around shank, no space between upper and lower fifth wheel, locking lever in lock position, safety catch in place
- Fails to note or cannot recognize if there is adequate clearance between the frame of the tractor and landing gear, adequate clearance between the top of the tractor drive wheels and nose of the trailer

Performing Coupling Procedures

Does not properly secure tractor and/or trailer at points called for in the coupling procedure

Crosses the air lines when he connects them or does not assure that glad hands are properly seated

Does not secure air lines before coupling and leaves them in a position to be snagged or tangled or when not enough slack which will result in glad hands becoming uncoupled

Does not completely raise landing gear or secure turn handle

Improperly connected electrical cable, e.g., fails to engage safety catch or latch, does not see that cable is secure to prevent chaffing or other damage

Safety of Individual

Attempts to go under the trailer when it is only supported by landing gear

Does not use safety precautions when connecting air lines or electrical cable, e.g., check surface and bottom of shoes for grease, climb on and off rails safely

Uncoupling

Does not assure that tractor and trailer are in line before uncoupling

Does not properly secure tractor and/or trailer when called for in uncoupling procedure

Fails to ease pressure on kingpin or does so improperly before uncoupling

Not able to recognize when landing gear are lowered sufficiently for uncoupling

Uses excessive speed when partially clearing tractor from trailer or pulls too far forward

Fails to keep feet and legs clear of vehicle wheels when releasing fifth wheel latch

Fails to inspect landing gear and surface after uncoupling or does so improperly

Does not properly secure air lines and electrical cable

Evaluation

Student performance will be evaluated against the ability to complete the exercise following all steps listed on the Coupling Procedures Checklist and Uncoupling Procedure Checklist.

2. COUPLING AND UNCOUPLING: PROFICIENCY DEVELOPMENT

Purpose

The purpose of this exercise is to provide an opportunity for student practice to develop coupling and uncoupling skills.

Range Layout

Practice occurs on the range each day as units are being prepared for range and street lessons and at the end of the day, when units are separated for cleaning and maintenance.

Directions

1. Students practice coupling and uncoupling procedures using same procedure described in the initial student practice.

   Will alternate reading checklist or observing and practicing on a day to day basis.

2. Instructor will observe and evaluate practice.

   Can observe at least two vehicles
   Observations can discontinue when instructor is certain that student(s) can safely practice without supervision.

3. Instructor will allow unsupervised practice

   When students have demonstrated that they can perform the coupling and uncoupling procedure safely and with the correct sequence, they should be assigned to unsupervised practice. The instructor need only spot check their work.

Observation

See Observation in Coupling and Uncoupling: Demonstration and Practice

Evaluation

Student performance will be evaluated against progress towards the standards required in the Pre-Street Range Test which requires the ability to perform coupling/uncoupling procedures:

- Safely and correctly and in the exact sequence taught in the checklists
- Without the aid of the checklist or other student or instructor assistance
- Within the time limits required, 5 minutes for either operation (if weather conditions are proper and all equipment is functioning properly)

Notes:

UNIT 1.7 COUPLING PROCEDURES CHECKLIST

1. Inspect Fifth Wheel

    Check for damaged/missing parts and proper lubrication
    Make sure fifth wheel is tilted toward rear of tractor, jaws open and release handle in the automatic lock position

2. Position Tractor Squarely in Front of Trailer; Never Drive under Trailer at an Angle

    Use left mirror to line up outside edge of left rear outer dual wheel with outer edge of trailer
    Check alignment by sighting down side of trailer
    Make final check with both mirrors to make sure tractor-trailer is aligned

3. Back Slowly until Jaws Just Touch Pickup Apron of Trailer

4. Secure the Trailer

5. Inspect the Area and Chock Front and Back of Left Trailer Wheels

    Secure any cargo against movement of tractor coupling
    If trailer is equipped with spring loaded brakes, it is not necessary to chock wheels

6. Make Visual Check of Trailer Height

    Trailer should be slightly lower than fifth wheel
    Never go under trailer that is not supported by tractor

7. Connect air lines to trailer

    Check washers (rubber grommets) on all four glad hands to make sure they are not damaged and glad hands are properly seated to prevent air leaks
    Make sure air lines are safely supported so they won't be crushed or caught while tractor is backing under the trailer
    Make sure there is enough slack that glad hands won't become uncoupled

8. Supply Air to Trailer

    Apply and release trailer brake to check for crossed lines
    Check system for signs of excessive air loss

9. Apply Trailer Brakes to Prepare for Backing under Trailer

    Use trailer spring brakes if there are no trailer brakes
    If there are no trailer brake or spring brakes, make sure trailer wheels are firmly chocked against movement

10. Back Slowly under Trailer until Fifth Wheel Engages Kingpin

    Be prepared for tractor to jump when it squats from trailer weight; if this happens, brake fast to keep air lines from being torn off

11. Check Connection for Security by Pulling Tractor **Gently** Forward

12. Repeat Step 11, Then Release Trailer Brake

13. Secure Vehicle

14. Visually Inspect Coupling

    Need to use flashlight and get under trailer
    Fifth wheel must be engaged on shank of kingpin and there should be no space between upper and lower fifth wheel
    Locking lever must be in "lock" position
    Safety catch must be in position over locking lever; sometimes this is done manually or with a cotter pin

15. Connect the Electrical Cable

    Don't force the connection if it doesn't fit
    If plug is not compatible with trailer connector, use a converter plug
    Make sure safety catch or latch is engaged after it plug is firmly seated
    Make sure air and electrical lines are properly secured/suspended

16. Raise Landing Gear

    Check to make sure there is adequate clearance between rear of tractor frame and landing gear to accommodate arc of tractor frame on sharp turns (especially important with tandem axle tractor and/or sliding fifth wheel)
    Landing gear must be fully raised and crank handle safely secured

17. Remove Tractor Wheel Chocks and Stow in Safe Place

UNIT 1.7 UNCOUPLING PROCEDURES CHECKLIST

Step Description

1. Position Vehicle

   Position tractor directly in front of trailer
   Make sure surface can support trailer; use trailer supports if necessary

2. Apply the Trailer Brake

3. Place Tractor Protection Valve in Emergency Position

4. Secure Landing Gear

5. Lower Landing Gear

   Empty trailer: lower to firm contact with surface
   Loaded trailer: turn crank in lower gear a few extra turns (enough to remove some weight from tractor suspension)

6. Disconnect Air Lines and Electrical Cable

   Secure lines against snagging or other damage

7. Release Fifth Wheel Latch

   If handle will not move, release trailer brake and back tractor gently to ease pressure
   If you cannot reach latch, use pull handle or hook
   Keep feet and legs clear of tractor wheels as tractor can be pushed forward

8. Pull Tractor Partially Clear of Trailer

   Stop with tractor frame stubs under trailer to prevent trailer from falling to ground if landing gear collapses or sinks

9. Secure Tractor

10. Inspect Trailer Supports

    Use trailer safety jack under nose of trailer if necessary

11. Pull Tractor Completely Clear of Trailer

Notes:

UNIT 1.8
PROFICIENCY DEVELOPMENT:
BASIC CONTROL

UNIT 1.8 PROFICIENCY DEVELOPMENT: BASIC CONTROL

PURPOSE

The purpose of this unit is to enable students to gain the proficiency in basic vehicle control needed to safely undertake the instruction in Safe Operating Practices in Section 2 of the curriculum.

OBJECTIVES

Performance Objectives

Students must be able to perform the following to the level of proficiency required to permit safe entry into onstreet instructions:

- Maneuvering through sharp turns (e.g., offset or alley) in both directions.
- Maneuvering through a series of sharp turns (e.g., serpentine) in both directions.
- Maneuvering into areas restricted to the rear, sides, and front (e.g., alley dock in both a straight line and jackknife (both sides) position.
- Parallel parking.
- Judging the position of the right wheel.
- Judging clearances at the rear, front, sides, and overhead.
- Maintaining proper vehicle and engine speed on upgrades and downgrades.

Knowledge Objectives

No new objectives.

Skill Objectives

The students must be able to

- coordinate acceleration and braking to maneuver the vehicle with a high level of proficiency.
- coordinate clutch, throttle and gear shift to maintain engine at proper speed when shifting on upgrades and downgrades.

Attitude Objectives

No new objectives.

LESSONS

Lesson 1.	Introduction to Proficiency Development Exercises (Classroom)	1 hour 30 minutes
Lesson 2.	Proficiency Development Exercises (Range)	36 hours
Lesson 3.	Proficiency Development: Practice in Basic Control (Street)	18 hours

LESSON 1 INTRODUCTION TO PROFICIENCY DEVELOPMENT EXERCISES (CLASSROOM)

Overview

Time Alloted: 1 hour 30 minutes

Prerequisites: Unit 1.7

Purpose:

The information in this lesson describes the driving range exercises that will be practiced prior to the Pre-Street Range Test, the dimensions and scoring criteria of the Pre-Street Range Test and the requirements of the onstreet proficiency development exercises. The purpose of this lesson is to prepare the student for those activities that are required in Lessons 2 and 3 of this Unit, before the student can proceed with the safe driving instruction beginning in Unit 2.1 of the curriculum.

Materials

Instructional Aids

Visuals 1-7

Student Material

Score sheet - Range Test In/End of Course, in Unit 1.8 of Student Manual

Range Observer's Checklist, in Unit 1.8 of Student Manual

Rules for Range Exercises, in Unit 1.1 of Student Manual

Road Observer's Checklist, in Unit 1.8 of Student Manual

Rules for Onstreet Driving, in Unit 1.1 of Student Manual

Instructor Material

Score Sheet - Range Test In/End Course (at end of lesson)

Range Observer's Checklist (at end of lesson)

Rules for Range Exercises, in Unit 1.1 of Student Manual

Road Observer's Checklist (at end of lesson)

Rules for Onstreet Driving, in Unit 1.1 of Student Manual

Review instructions covering the administration of the Pre-Street Range Test in the School Administrator's Manual for this curriculum

IMPORTANT TECHNICAL NOTE: All range exercises dimensions are only approximations. You must modify the dimensions according to the vehicle being used and remember that the A. settings are for entry or novice students, B. is for intermediate levels and C. is the settings for the advanced level students. For full details, refer to the "Lab and Range" segment of the "General Instructions" sections for the "Introduction" Chapter of The Instructor Manual.

Content

Activity or Topic	Approximate Time
1. RANGE EXERCISES AND PRACTICE	15 minutes
2. PRE-STREET RANGE TEST	45 minutes
3. ONSTREET PROFICIENCY DEVELOPMENT EXERCISES	30 minutes
	1 hour 30 minutes

1. RANGE EXERCISES AND PRACTICE (15 minutes)

Overview of Range Exercises

Purpose of Range Exercises

To further develop student skills (taught in previous units) in basic vehicle control by providing instruction and supervised practice in

- Timing and coordination in manipulation of vehicle controls, e.g., steering wheel, accelerator and brake pedal
- The six basic spatial requirements of a tractor-trailer which are:
    1. Space in front (swing clearance)
    2. Space above (overhead clearance)
    3. Space on right side (passing clearance)
    4. Space on left side (passing clearance)
    5. Space to the rear (swing clearance)
    6. Space below (undercarriage clearance)
- Safe and efficient techniques for performing such maneuvers as:

    Straight line backing
    Angle backing into tight spaces
    Negotiating offset alleyways
    Parking at loading docks
    Parallel parking
    Weaving around obstacles in path
    Controlled stops

Instructors will briefly demonstrate each range exercise for students

Students will then perform the exercise while being closely guided by the instructor

Working in 3 person teams, students will practice these exercises with aid of team members and instructors

Practice will continue until students have attained enough vehicle handling judgement and skills to safely engage in onstreet training lessons

Skill attainment is determined by achieving a passing score on the Pre-Street Range Test

After passing the Pre-Street Range test, students will alternate between onstreet lessons and continued practice of the range exercises, which will be gradually tightened up until space and time requirements are set at the final level needed to pass the Driving Range Portion of the Final Examination Test Battery

Students will continue to practice at this final level of difficulty until graduation time

NOTE: Range exercises have 3 levels of difficulty, setting A. is for novice students and is also the setting used for the Pre-Street Range Test. Setting B. is for intermediate students and setting C. is for advanced students. Setting C. is also used for the Range Test portion of the Final Examination Test Battery.

Exercise Objectives

Visual 1 Straight Line Backing

Straight Line Backing Exercise

To further develop student ability to rapidly and smoothly back the vehicle in a straight line for a distance of 150 feet through lanes that become increasingly narrower as student become more proficient

Visual 2 Offset Alley Exercise

To develop the ability to operate a tractor-trailer in a restricted roadway or alley in a path that is "offset" so as to require a sharp right or sharp left turn. The space between the barricades or "alleys" will gradually be reduced as students become more proficient

Visual 3 Alley Dock Backing

Alley Dock Backing Exercise

To develop the ability to back a rig into a restricted space, in a minimum amount of time, smoothly, safely and be able to stop without striking the "dock" (in this case the rear barricade)

Students will perform this exercise using three methods

Backing in from the sight (left) side and ending up with the tractor-trailer in a straight line at the "dock"

Backing in from the blind (right) side and ending up with the tractor-trailer in a straight line at the "dock"

Backing in from the sight (left) side and ending up with the trailer at the "dock" and with the tractor jackknifed (at a full 90 degree angle) to the trailer

NOTE: Students should be taught that blind side backing maneuvers are to be avoided whenever possible and when unavoidable, a helper shall be used. In this course, a student helper is always mandatory. Blind side backing is taught for experience only - students will not be tested on this maneuver.

As students gain experiences and skill the width of the simulated alley dock is gradulaly closed up until they are practicing the maneuver at the final level of difficulty

Visual 4 Serpentine - Forward and Reverse

Forward and Reverse Serpentine Exercises

To develop ability to maneuver a rig in a restricted space requiring rapid turns from right to left and back again, while traveling in either a forward or backward direction

The distance between the 55-gallon drums is gradually decreased as students become more proficient.

Visual 5 Parallel Parking - Jackknifed

Parallel Parking - Jackknifed Exercise

To develop the ability to parallel park a tractor-trailer at the curb both in a straight and in a jackknifed position between two parked vehicles (simulated with barricades)

As students develop their skills the distance between the two "parked cars" (barricades) is gradually reduced

NOTE: Students wil be taught parallel parking first for experience only - students will only be tested on jackknifed parallel parking

REMOVE VISUAL

Controlled Stop Line Exercises

To develop student ability to stop smoothly at a predetermined point and to know where both the front bumper and front wheels of the tractor are (in relation to other objects)

This is done by using stop lines painted on the ground at the beginning and/or end of most of these other range exercises, students then practice stopping with the front (steering wheels) on top of this line; then stopping with the front bumper as close to the line as possible without going over it; and stopping as they exit an exercise with the rear bumper of the trailer as close as possible to the line (after crossing the line)

These controlled stops are practiced with a single brake application only and must be smooth (non-abusive to the vehicle) as evidenced by a lack of the tractor's front end "rebound" (bounce) and/or an audible sound of compressed air being exhausted

As students develop skill they will be required to stop closer and closer to the stop line without going over it

NOTE: Students will first practice stopping with steering wheels on top of the stop line and with rear bumper of trailer stopping as close as possible to the exit line, however, students will only be tested on their ability to stop with the front bumper as close as possible to the stop line without actually going over it

Visual 6 Overhead Clearance

Overhead Clearance Exercise

To enable students to develop the ability to judge the amount of overhead clearance that their trailer and/or its load requires to safely pass under an overhead object, i.e., bridges, trees, signs

As students develop this judgement, the overhead bar is constantly changed until students can estimate closer and closer clearances

2. PRE-STREET RANGE TEST (45 minutes)

Purpose of Pre-Street Test

Test is used as an objective measuring device to determine when students have attained a sufficient degree of knowledge, skill and judgement of vehicle spatial requirements and self confidence necessary to commence the basic onstreet training lessons

If student passes--
    Helps assure ability to maneuver in tight quarters and avoid collisions onroad.
If student fails--
    Helps identify required remedial or additional training needed to continue course.

General Description of Pre-Street Range Test

Same test that is given at end of course but standards are not as difficult. Consists of nine range exercises plus coupling, uncoupling, and vehicle pretrip inspection.

- Coupling, uncoupling and pretrip inspection may be tested at separate time from these nine range exercises.

Practice Prior to Pre-Street Range Test

- Range exercises in Lesson 3 of this unit, plus practice in previous Units are designed to prepare students for the Pre-Street Range Test.
- Practice also helps students prepare for end-of-course (Final Exam) Range Test.

Procedure

1. Student teams (previously assigned) work together at all times with the vehicle assigned to them.

2. The three person team members alternate from being drivers to being observers.

3. A driver shall operate the vehicle through the exercise, if successful, another person then becomes the driver. If unsuccessful, they shall make a second attempt. If they again fail and/or the time exceeds 6 minutes, then they shall surrender the vehicle to the team member due to drive next.

4. Students who are acting as observers shall use their checklists (provided in the student manual) to record the errors made by their teammates.

5. Observers shall aid drivers by picking up and/or repositioning barricades or traffic cones that have been struck or moved.

6. Observers must be alert and attentive at all times for everyone's safety. Be ready to signal your team's driver to stop should another vehicle approach too close to his/her intended path, or the vehicle is about to damage a barricade or stanchion (remember bumping it is counted on your checklist). However, if the driver is not alert enough and continues into the object, he/she must be signaled to stop quickly to prevent damage.

7. Observers must always stand clear of the vehicles path of travel and shall always be visible to the driver in either one mirror or the other (or windows).

8. Drivers who cannot see their observers shall stop immediately! Do not move the vehicle again until such time as both your observers are again in your view.

9. Remind students to review "Rules for Range Exercises" in Student Manual (Unit 1.1).

Visual 7 Standards for Pre-Street Range Test

Description of Standards for Range Exercises

Kinds of Standards

Four standard measures can be specified and scored for each range exercise:

- Motion control
    - Number of stops and direction changes allowed.
    - Direction change counts as two errors since it includes both a stop and a direction change.
- Contact
    - Touches--slight contact with exercise barrier or operating with wheels on boundary of exercise.
    - Hits--striking a barrier and/or moving it out of position.
    - Exceeds--operating with vehicle wheels over exercise boundary or the vehicle body extends over exercise boundary, even when wheels do not.

Distance

Position of vehicle on completion of exercise, e.g., that is whether or not the vehicle is within the required number of inches of the exercise boundary or barricade

Time

Total time in seconds or minutes between start and finish areas of exercise.

Review Score Sheet - Range Test In/End Course

The "Score Sheet - Range Test In/End Course", side one and side two, found at end of this lesson. Have them follow along while you discuss how they will be scored on the In-Course (meaning the Pre-Street Test) portion of the test.

Discuss the following:

Objective method of scoring

Each scoring criteria can be answered "yes" or "no," e.g., Did the student identify all the problems in pretrip inspection? Did the student complete the backing exercise without stopping? Did the student complete the exercise within the time limit?

If students take double (or more) the amount of time allotted for an exercise, will receive "no" answers for all of the scoring criteria on that exercise.

Criteria for passing Pre-Street Range Test

Final scoring is based on percent of "yes" answers.
Must receive enough "yes" answers to pass (a score of 75 percent is passing)

Meaning of failure of Pre-Street Range Test

Cannot proceed with course.
Can retake test after more training and practice.

Review Range Observer's Checklist

The Range Observer's Checklist, (found at the end of this lesson) - students have copies in their manuals. Have them follow along while you discuss proper use of the checklist.

3. ONSTREET PROFICIENCY DEVELOPMENT EXERCISES (30 minutes)

Purpose

To provide practice in low/moderate density environments before going on to difficult road practice.
To allow development of the basic control skill necessary to learn safe operating practices.

Safe Operating Practices, in Section 2 of curriculum will require the driver's attention.
Basic control skills must become automatic.
Each student will get 6 hours of practice to make skills automatic.

Routes

Low Density Traffic Conditions

Each student will receive 3 hours of BTW practice time.
Routes provide minimum amount of traffic, e.g., suburban driving proceding from no traffic to a little traffic.

Moderate Density Traffic Conditions

Each student will receive 3 hours of BTW practice time.
Routes are selected to provide more traffic, e.g., moderately heavy traffic in suburban areas

Procedure

1. Three-person teams assigned to a road rig.
2. Twenty-minute shifts behind the wheel.
3. Other students observe, using checklists (provided in student manual) to record errors.
4. Remind students to review "Rules for Onstreet Driving in Unit 1.1 of Student Manual

Evaluation

Students will be evaluated on the following:
Smooth acceleration
Smooth braking and ability to stop at a designated point
Proper upshifting and downshifting
Correct uphill/downhill operation
Adjusting speed for curves
Proper position and procedures for turns and curves
Lane keeping while going straight ahead, on curves and turns

Review Road Observer's Checklist

The "Road Observer's Checklist," (found at end of this lesson) - Students have copies in their manuals. Have them follow along while you discuss proper use of the checklist.

Recap

Allow time for student questions and answers.

Notes:

SCORE SHEET - RANGE TEST IN/END COURSE

Exercise	Score
BACKING - STRAIGHT LINE	
1 Motion Control	YES NO
2 Contact	YES NO
3 Time	YES NO
OFFSET ALLEY	
4 Motion Control	YES NO
5 Contact	YES NO
6 Time	YES NO
ALLEY DOCK	
7 Motion Control	YES NO
8 Contact	YES NO
9 Distance	YES NO
10 Time	YES NO
ALLEY DOCK - JACKKNIFED	
11 Motion Control	YES NO
12 Contact	YES NO
13 Distance	YES NO
14 Jackknife Posiiton	YES NO
15 Time	YES NO
SERPENTINE/FORWARD	
16 Motion Control	YES NO
17 Contact	YES NO
18 Time	YES NO
SERPENTINE/REVERSE	
19 Motion Control	YES NO
20 Contact	YES NO
21 Time	YES NO
PARALLEL PARKING - JACKKNIFED	
22 Motion Control	YES NO
23 Contact	YES NO
24 Distance	YES NO
25 Time	YES NO
CONTROLLED STOP LINE	
26 Distance	YES NO
27 Smoothness	YES NO
OVERHEAD CLEARANCE	
28 Correct Decision	YES NO
29 Time	YES NO

Exercise	Score
PRETRIP INSPECTION	
30 Approaching Vehicle	YES NO
31 Under Hood	YES NO
32 Inside Cab	YES NO
33 Lights	YES NO
34 Walkaround Vehicle	YES NO
35 Signal Lights	YES NO
36 Air Brake System	YES NO
37 Problems Identified	YES NO
38 Time	YES NO
COUPLING	
(Pre-Couple)	
39 Motion Control	YES NO
40 Contact	YES NO
41 Chocks	YES NO
42 Air Hookup	YES NO
43 Air Supply	YES NO
44 Trailer Brakes	YES NO
(Couple)	
45 Hookup	YES NO
46 Test Hookup	YES NO
47 Inspects Coupling	YES NO
(Post Couple)	
48 Electrical Hookup	YES NO
49 Landing Gear	YES NO
50 Chocks	YES NO
51 Time	YES NO
UNCOUPLING	
(Pre-Uncoupling)	
52 Positions Vehicle	YES NO
53 Trailer Air Off	YES NO
54 Secures Tractor	YES NO
55 Lowers Landing Gear	YES NO
56 Disconnect Lines	YES NO
57 Stores Lines	YES NO
58 Fifth Wheel Release	YES NO
(Uncouple)	
59 Pulls Tractor Forward	YES NO
60 Secures Tractor	YES NO
(Post-Uncouple)	
61 Checks Landing Gear	YES NO
62 Pulls Tractor Clear	YES NO
63 Time	YES NO

Total # Passed___Total # Failed)___

Percent Correct ________________

Student________________________

Examiner________________________

An explanation of scoring is provided on the back.

SUMMARY OF CRITERIA RANGE TEST IN/END COURSE

BACKING - STRAIGHT LINE
Motion Control: No changes or stops
Contact: Does not touch lane boundaries
Time: 90 sec. in course; 60 sec. at end-of-course

OFFSET ALLEY
Motion Control: No changes or stops
Contact: 2 or less touches; 1 or no hits in course; no touches or hits at end-of-course
Time: 90 sec. in course; 45 sec. at end-of-course

ALLEY DOCK
Motion Control: 4 or less changes or stops in course; 2 or less at end-of-course
Contact: 2 or less boundary/barricade touches or hits in course; none allowed at end-of-course
Distance: Stops 24 in. or less from back of dock; 12. in or less at end-of-course
Time: 4 min. 30 sec. in course; 2 min. 30 sec. at end-of-course

ALLEY DOCK - JACKKNIFED
Motion Control: 4 or less changes or stops in course; 2 or less at end-of-course
Contact: 2 or less boundary/barricade touches in course; none allowed at end-of-course
Distance: Stops 30 in. or less from dock (no hit) in course; 18 in. or less (no hit) end-of-course
Jackknife Position: Leaves tractor 90 degrees to trailer
Time: 4 min. 30 sec. in course; 2 min. 45 sec. at end-of-course

SERPENTINE - FORWARD
Motion Control: No changes or stops
Contact: No touching or hitting drums or street boundary delineators
Time: 60 sec. in course; 45 sec. at end-of-course

SERPENTINE - REVERSE
Motion Control: 4 or less changes or stops in course; 2 or less at end-of-course
Contact: No touching or hitting drums or street boundary delineators
Time: 4 min. or less in course; 2 min. 30 sec. or less at end-of-course

PARALLEL PARKING - JACKKNIFED
Motion Control: 4 or less changes or stops in course; 2 or less changes or stops at end-of-course
Contact: 2 or less curb touches, no curb crosses or barricade hits in course; none at end-of-course
Distance: Trailer 24 in. or less from curb in course; 12 in. or less at end-of-course
Time: 4 min. in course; 2 min. 30 sec. at end-of course

CONTROLLED STOP LINE
Distance: Stops 18 in. or less from line in course; 6 in. or less at end-of-course
Smoothness: Minor nose rebound and audible air release allowed in course; none allowed at end-of-cour

OVERHEAD CLEARANCE
Correct decision: Clears within 6 inches or less
Time: 90 sec. in course; 45 sec. at end-of-course

PRETRIP INSPECTION
Inspects required components in Items 30 thru 36
identifies all real and simulated defects
Time: 30 min. in course; 15 min. at end-of-course

COUPLING
(Pre-couple)
Motion Control: 3 or less changes or stops in course; 1 or less at end-of-course
Contact: Tractor backed slowly, 5th wheel jaws just touch (not hit) pickup apron
Chocks: Chocks front and back of left trailer wheels
Air Hookup: Lines not crossed
Air Supply: Supplies air to trailer
Trailer Brakes: Applies trailer brakes
(Couple)
Hookup: Backs slowly until 5th wheel engages king-pin
Test Hookup: Moves forward checking hookup (Twice)
Inspects Coupling: Visually checks by crawling under trailer
(Post Couple)
Electrical Hookup: Hooks up cable
Landing Gear: Raises landing gear fully, secures crank handle
Chocks: Removes trailer wheel chocks
Time: 18 min. in course; 8 min. at end-of-course

UNCOUPLING
(Pre-uncouple)
Positions vehicle
Shuts off trailer air supply
Secures tractor
Lowers landing gear proper distance
Disconnects and properly stores air and electrical lines
Releases fifth wheel latch
(Uncouple)
Pulls tractor forward only until 5th wheel is clear
Secures tractor with frame ends under trailer nose
(Post-Uncouple)
Checks trailer landing gear for stability
Pulls tractor clear from trailer
Time: 10 min. in course; 5 min. at end-of-course

Notes:

Notes:

UNIT 1.8 RANGE OBSERVER'S CHECKLIST

If a driver makes an error during one of the exercises listed below, place a tally mark in the box.

	DRIVER		
BACKING - STRAIGHT LINE	#1	#2	#3
Failure to Adjust Mirrors			
Improper Coordination			
Improper Speed Control			
Improper Mirror Usage			
Improper Steering Control: Oversteering			
Late Adjustments			
Improper Adjustments			
Stop Line			

	DRIVER		
OFFSET ALLEY	#1	#2	#3
Speed (Forward)			
Steering (Forward)			
Improper Starting Position			
Failure to Adjust Mirrors			
Improper Coordination			
Improper Mirror Usage			
Improper Steering Control: Oversteering			
Late Adjustments			
Improper Adjustments			
Stop Line			

	DRIVER		
ALLEY DOCK	#1	#2	#3
Improper Starting Position			
Failure to Adjust Mirrors			
Improper Coordination			
Improper Speed Control			
Improper Mirror Usage			
Improper Steering Control: Oversteering			
Late Adjustments			
Improper Adjustments			
Stop Line			

	DRIVER		
SERPENTINE FORWARD	#1	#2	#3
Turning			
Speed			
Steering			
Stop Line			

	DRIVER		
SERPENTINE REVERSE	#1	#2	#3
Improper Starting Position			
Failure to Adjust Mirrors			
Improper Coordination			
Improper Speed Control			
Improper Mirror Usage			
Improper Steering Control: Oversteering			
Late Adjustments			
Improper Adjustments			
Stop Line			

	DRIVER		
PARALLEL PARKING-JACKKNIFED	#1	#2	#3
Improper Starting Position			
Failure to Adjust Mirrors			
Improper Coordination			
Improper Speed Control			
Improper Mirror Usage			
Improper Steering Control: Oversteering			
Late Adjustments			
Improper Adjustments			
Stop Line			

	DRIVER		
CONTROLLED STOP LINE	#1	#2	#3
Rough Stop			
More Than One Stop Made			
Tractor Bumper: Stops Short of Line			
Goes Over the Line			
Trailer Bumper: Stops Short of Line			
Goes Over the Line			

	DRIVER		
OVERHEAD CLEARANCE	#1	#2	#3
Accepts Unsafe Clearance			
Refuses Safe Clearance			
Stop Line			

An explanation of errors is provided on the back.

READEX FICHE

Explanation of Driver Errors on Unit 1.8 Range Observer's Checklist

Improper Starting Position--Failing to properly align the tractor- trailer and aim it at its intended target.

Failure to Adjust Mirrors--Failing to adjust mirrors before starting the backing maneuver.

Improper Coordination--Jerky, abrupt acceleration and stalling indicate inability to smoothly coordinate the basic vehicle controls when backing.

Improper Speed Control--Backing too fast, changing speeds or braking during the backing maneuver are errors indicating poor speed control.

Improper Mirror Usage--Opening the door to look out or failing to recognize when steering adjustments should be made indicating errors in mirror usage.

Improper Steering Control

> Oversteering--Making too frequent steering adjustments, such as making a steering adjustment too soon and then immediately following up with a corrective action.
>
> Making Adjustments Too Late--Making steering adjustments too late, resulting in having to pull up and start again.
>
> Making Improper Steering Adjustments--Turning the wheel in the wrong direction to adjust the trailer's path or "jacking" the vehicle too hard, too much, or not soon enough. Or not allowing the vehicle to get back in line once the adjustment has been made, i.e., not straightening out the steering wheel.

Turning--The student turns too little and hits the cones or turns too much which causes continuous widening of the vehicle movements and misses the last cones.

Speed--The student fails to maintain a steady, smooth speed.

Steering--The student makes early or late steering inputs that result in positioning the vehicle improperly.

Stop Line--Fails to stop within required number of inches of the stop line.

Accepts Unsafe Clearance--Attempts to proceed under barrier when it is too low.

Refuses Safe Clearance--Does not proceed when clearance is high enough to allow vehicle to pass underneath.

Notes: ______________________________

Notes:

UNIT 1.8 ROAD OBSERVER'S CHECKLIST

If a driver makes a driving error in one of the categories below, place a tally mark in the box.

BASIC CONTROL ERRORS	Driver #1	Driver #2	Driver #3
Acceleration			
Braking			
Stopping			
Upshifting			
Downshifting			
Uphill Operation			
Downhill Operation			
Speed Adjustment/Curves			
Lane-Keeping/Straight			
Lane-Keeping/Right Turn			
Lane-Keeping/Left Turn			
Lane-Keeping/Curves			

An explanation of errors is provided on the back.

Explanation of Driver Errors on Unit 1.8 Road Observer's Checklist

Acceleration--Jerky and abrupt, from a standing start or when increasing speed.

Braking--Smooth controlled stop, no rebound of front end or sound of exhausting air.

Stop Line--Stopping beyond stop line or other designated stopping point.

Upshifting--Includes the following errors:

- stalling
- operating out of the designated rpm range
- lugging
- delayed shift between gears (losing over 500 rpm)
- missed shift (having to drop back into another gear)
- gear clash

Downshifting--Includes the following errors:

- operating out of the designated rpm range
- gear/engine mismatch resulting in lurch as clutch is released
- delayed shift
- over or under revving between gears
- gear clash

Uphill Operation--Includes the following errors:

- lugging (failure to shift soon enough)
- excessive loss of speed (having to reaccelerate on hill)
- roll-back when starting from a standing point

Downhill Operation--Includes the following errors:

- starting down the hill in too high a gear
- failing to maintain steady brake pressure (e.g., fanning)

Speed Adjustment/Curves--Entering curve or turn too fast, indicated by:

- sharp lateral acceleration (passengers thrown sideways)
- braking while within the curve or turn

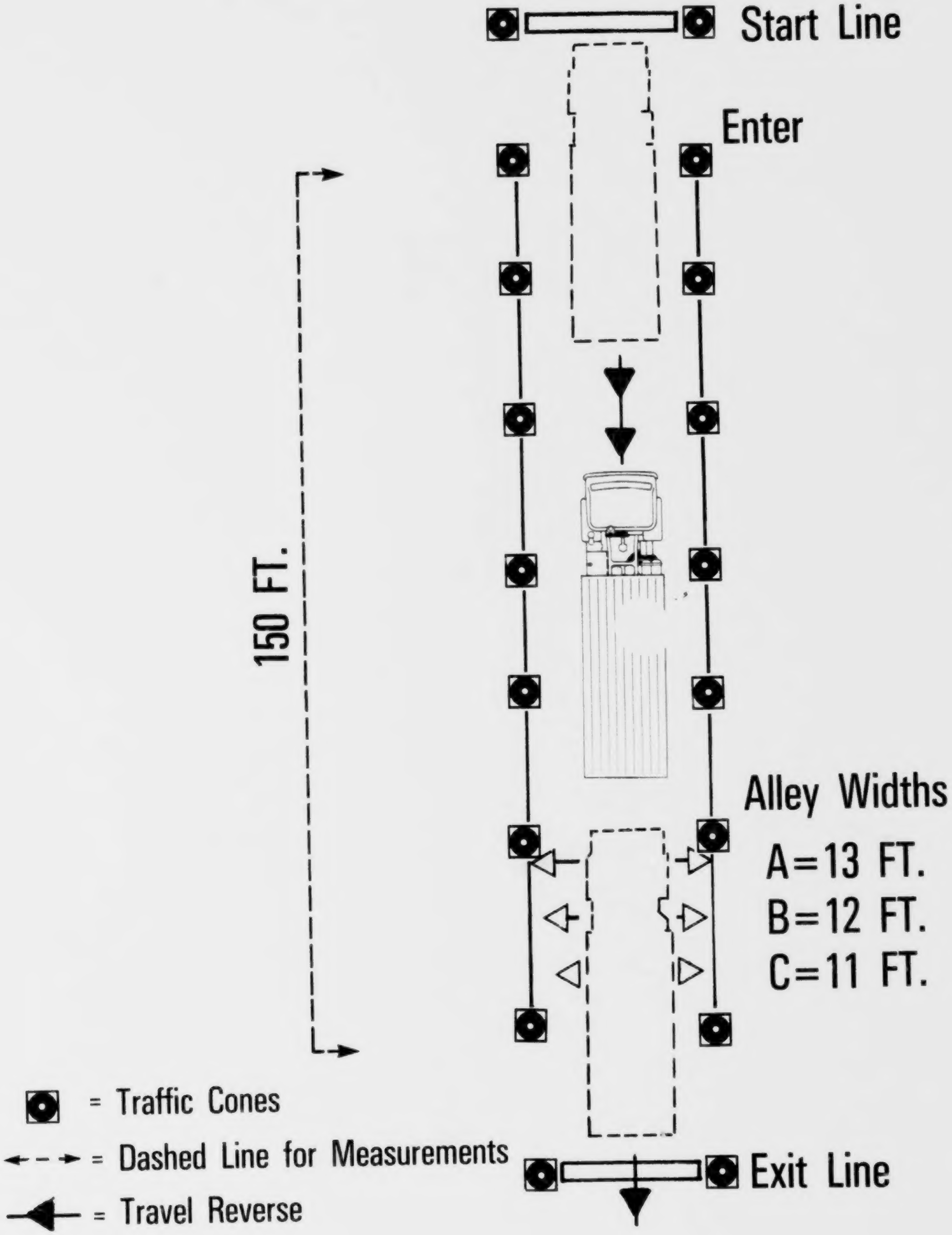
Lane-Keeping/Straight--Wandering back and forth between lines or touching, crossing lane markings on straightaway.

Lane-Keeping/Turns--Operating outside of the designated lane in turns.

Right Turns:	right rear wheels cutting across curb or road edge
Left Turns:	beginning left turn too early (cutting across lanes approaching from the left)
Curves:	wheels not kept within lane markings, fails to steer far left/right to compensate for the off-tracking of the trailer

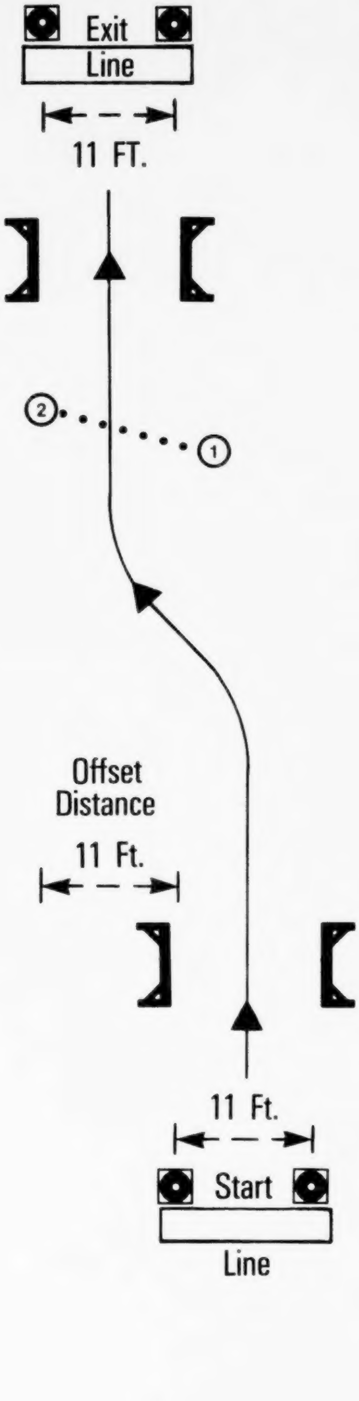
Visual 1

Straight Line Backing


Start Line
Enter
150 FT.
Alley Widths
A=13 FT.
B=12 FT.
C=11 FT.
Exit Line
= Traffic Cones
= Dashed Line for Measurements
= Travel Reverse

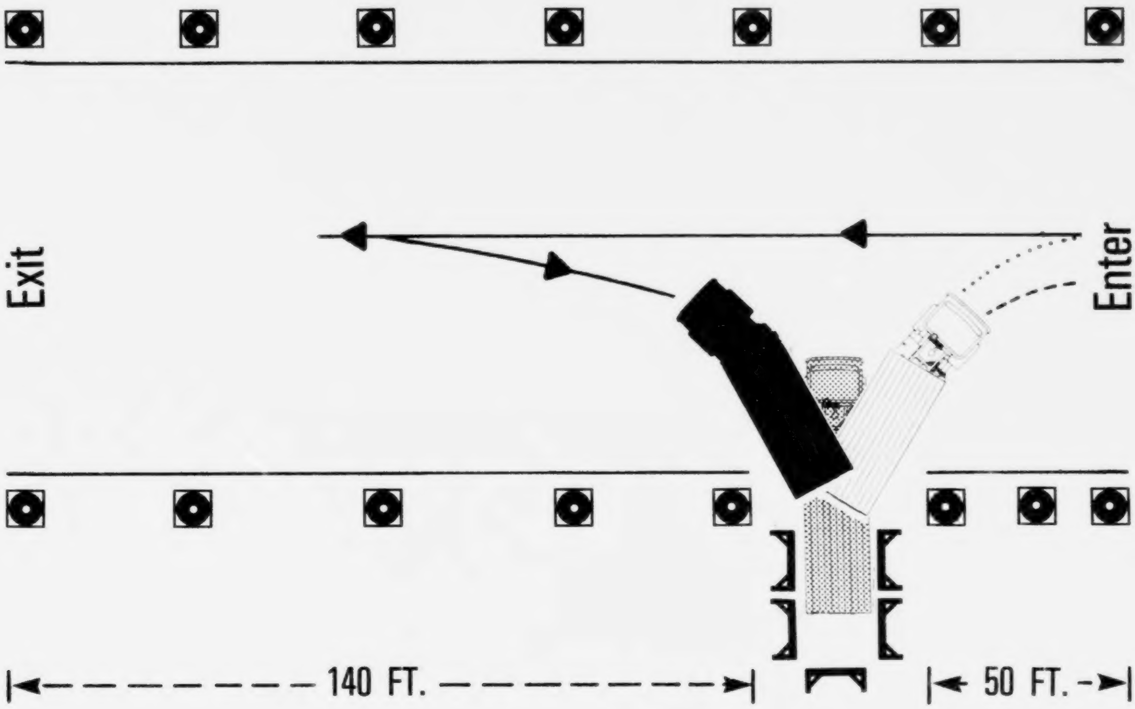
Visual 2

Offset Alley


Exit
Line
11 FT.
②
①
Offset
Distance
11 Ft.
11 Ft.
Start
Line

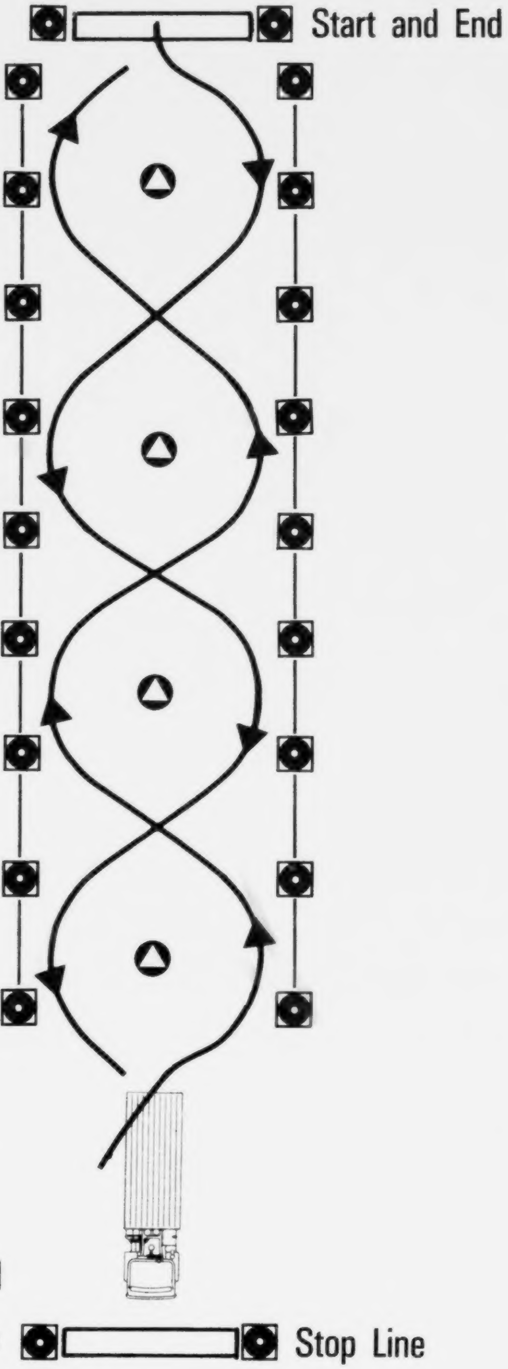
Visual 3

Alley Dock Backing



—◄—◄— = Forward Travel
—►—►— = Reverse Travel-Jackknifed to Left
- - - - - - - - = Reverse Travel-Straight in
·················· = Reverse Travel-Jackknifed to Right
◙ = Traffic Cones
⊓ = Barricades
←- - - - - - - -→ = Dashed Line for Measurements

Serpentine–Forward and Reverse


Start and End
Stop Line

◙ = Traffic Cones

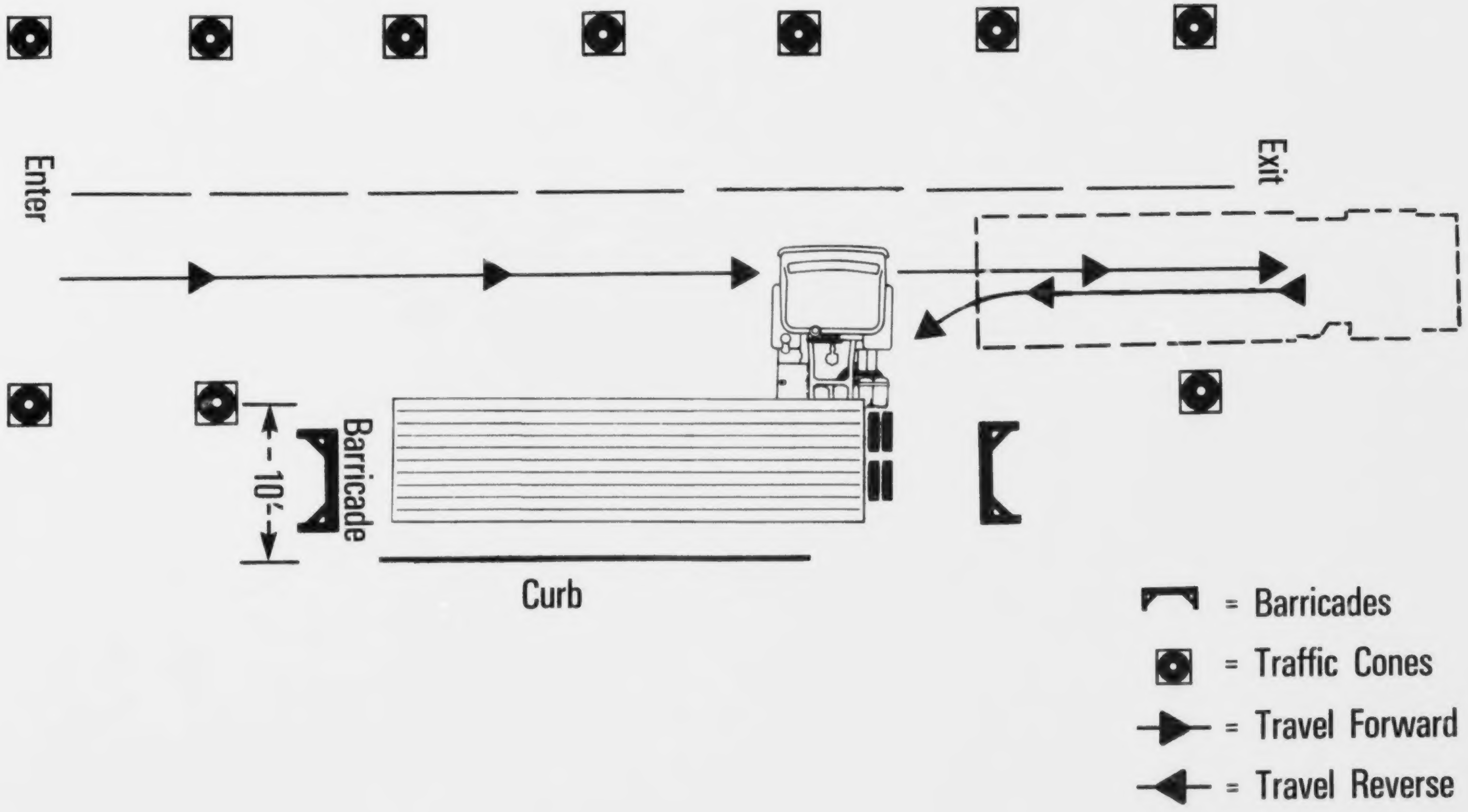
△ = Barrels

→ = Travel Forward

← = Travel Reverse

Visual 5

Parallel Parking—Jackknifed

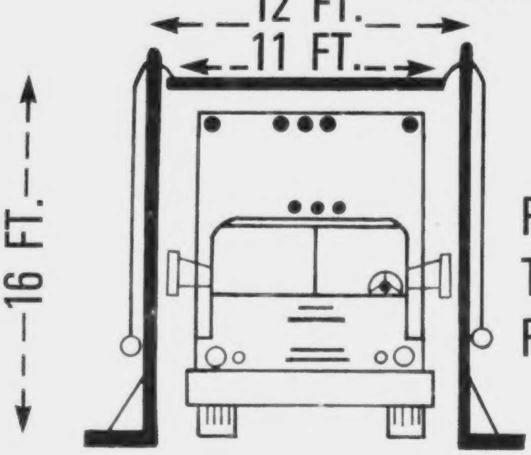


Enter
Exit
Barricade
10'
Curb
= Barricades
= Traffic Cones
= Travel Forward
= Travel Reverse

Visual 6

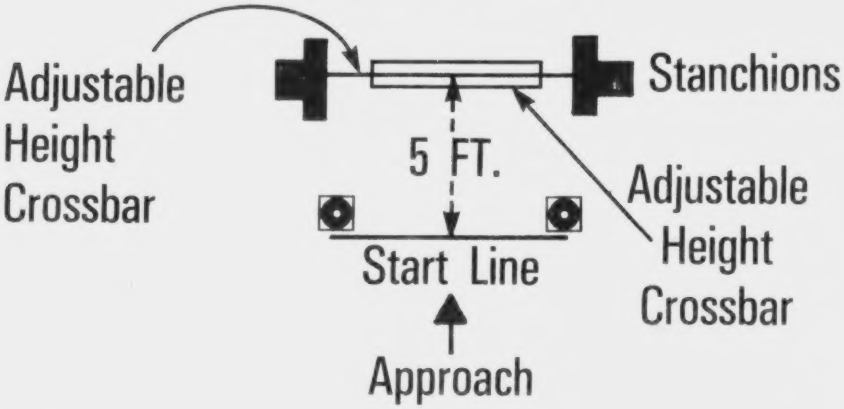
Overhead Clearance

Frontal View


12 FT.
11 FT.
16 FT.

Pull Ropes, Each Side, Running Thru Pulley at Top of Posts for Raising or Lowering Crossbar.

Overhead View


Adjustable Height Crossbar
Stanchions
5 FT.
Adjustable Height Crossbar
Start Line
Approach

◙ = Traffic Cones

←-→ = Dashed Line for Measurements

➔ = Travel Forward

Visual 7

Standards for Pre-Street Range Test

- Motion Control
  - Number of Stops and Direction Changes Allowed
- Contact
  - Touches –Slight Contact With Barrier or Wheels on Boundary Lines
  - Hits –Striking and/or Moving Barrier Out of Position
  - Exceeds –Wheels of Vehicle or Body Exceed Exercise Boundary Lines
- Distance
  - Position of Vehicle at End of Exercise
- Time
  - Minutes and/or Seconds Allowed for Completion of Exercise

LESSON 2 PROFICIENCY DEVELOPMENT EXERCISE (RANGE)

Overview

Time Allotted: 36 hours

Prerequisites: Unit 1.8, Lesson 1

Purpose:

The purpose of this lesson is to provide students with instruction and practice time, to enable them to gain sufficient proficiency in vehicle maneuvering skills to pass both the Pre-Street Range Test and the Driving Range portion of the Final Examination Test Battery. Students will work in their usual three person teams per vehicle/instructor. This provides a total of 12-hours per student of BTW time. Some students will learn faster than others and time saved with fast learners may be given over to the slower students, if absolutely necessary. However, all students must receive a mimimium of 10-hours BTW time.

Materials

Instructional Aids

None

Student Material

Range Observer's Checklist, in Unit 1.8 of Student Manual

Rules for Range Exercises, in Unit 1.1 of Student Manual

Instructor Material

Range Observer's Checklist (at end of previous lesson)

Rules for Range Exercises, in Unit 1.1 of Student Manual

Score Sheet - Range Test In/End of Course (at end of previous lesson)

Range Diagrams for the exercises 1, 2, 3, 4, 5, 6 and 8 (at end of this lesson)

IMPORTANT TECHNICAL NOTE: All range exercises dimensions are only approximations. You must modify the dimensions according to the vehicle being used and remember that the A. settings are for entry or novice students, B. is for intermediate levels and C. is the settings for the advanced level students. For full details, refer to the "Lab and Range" segment of the "General Instructions" section of the "Introduction" Chapter of The Instructor Manual.

Content

Activity or Topic	Approximate Time
1. BACKING - STRAIGHT LINE	4 hours
2. OFFSET ALLEY EXERCISE	4 hours
3. ALLEY DOCK EXERCISE	6 hours
4. ALLEY DOCK - JACKKNIFED EXERCISE	6 hours
5. SERPENTINE FORWARD AND REVERSE EXERCISE	6 hours
6. PARALLEL PARKING - JACKKNIFED EXERCISE	6 hours
7. CONTROLLED STOP LINE EXERCISE	xx
8. OVERHEAD CLEARANCE EXERCISE	4 hours
	36 hours

---

xx Included in other exercises.

1. BACKING - STRAIGHT LINE EXERCISE (4 hours)

NOTE: Students will have practiced straight line backing several times in Exercises in Units 1.4, 1.5, and 1.6.

Purpose

The purpose of this exercise is to further develop student ability to back a vehicle between in a restricted space for 150 feet and to develop proficiency towards the standards required in the Pre-Street Range Test.

Range Layout

Lane length - 150 feet
Setting A--13 foot wide lane
Setting B--12 foot wide lane
Setting C--11 foot wide lane
See Range Diagram, Exercise 1 (at end of this lesson)

Directions

1. Instructor will demonstrate the exercise (5 minutes).

2. Students will rotate from behind-the-wheel to posts on the range to observe, record and assist with the exercise.

3. Students will enter the lane from the exit end and position the rear of the trailer even with lane markers at the other (starting) end, then will back smoothly to the other end of the lane and stop smoothly, when front bumper of the tractor crosses over finish (exit) line.

4. Students should complete the maneuver as quickly as possible, while keeping the vehicle under control, and without making mistakes.

5. Once proficiency is developed at 13 foot width, the dimensions should be decreased to setting B. then setting C.

Observation

The instructor will observe to see that students practice the straight line backing maneuver using the procedures learned in class. Instructors should note and immediately correct any of the following errors.

Improper Starting Position

The student fails to properly align the tractor-trailer and aim it at its intended target.

Failure to Adjust Mirrors

The student fails to adjust his/her mirrors before starting the backing maneuver.

Improper Coordination of Vehicle Controls

Jerky, abrupt acceleration and stalling are signs that the student is not able to smoothly coordinate the basic vehicle controls when backing.

Improper Speed Control

Backing too fast, changing speeds or braking during the backing maneuver are errors indicating poor speed control.

Improper Mirror Usage

Opening the door to look out or failing to recognize when steering adjustments should be made indicate errors in mirror usage.

Improper Steering Control

Oversteering

The student makes too frequent steering adjustments, such as making a steering adjustment too soon and then immediately following up with a corrective action.

Making Adjustments Too Late

The driver makes the steering adjustment too late. If the tractor-trailer gets too far off the correct path, the driver will have to pull up and start again. Driver should be coached to "jack" the vehicle before this occurs.

Making Improper Steering Adjustments

The student turns the wheel in the wrong direction to adjust the trailer's path or "jacks" the vehicle too hard, too much, or not soon enough. Or does not allow the vehicle to get back in line once the adjustment has been made, i.e., doesn't straighten out the steering wheel.

Evaluation

Student performance will be evaluated against the following criteria:

- Positions vehicle properly to start exercise
- Uses mirrors properly to monitor motion of trailer
- Checks for clearance when required
- Uses mirrors properly to monitor vehicle position
- Makes proper steering adjustments using push-pull method
- Does not touch or run over exercise markers
- Completes each setting without the need to pull up and start over
- Does not use excessive time for exercise
  - Setting A--120 seconds
  - Setting B--100 seconds
  - Setting C--90 seconds

2. OFFSET ALLEY EXERCISE (4 hours)

Purpose

The purpose of this exercise is to develop student ability to laterally reposition the tractor-trailer in a restricted roadway or alley, while moving forward and to develop proficiency toward the standards required in the Pre-Street Range Test.

Range Layout

Two alleys each 11 feet wide and 10 feet long
Offset distance--11 feet
Distance between barriers:
Setting A--overall length of vehicle plus 10 feet
Setting B--overall length of vehicle plus 5 feet
Setting C--exact overall length of the vehicle
See Range Diagram, Exercise 2 (at the end of this lesson)

Directions

1. Instructor will demonstrate exercise (5 minutes).
2. Students will take turns rotating from behind-the-wheel to posts on range to observe, record and assist with the exercise.
3. Students will perform exercise.
4. Start by driving forward between exercise markers, stop once rear of vehicle has cleared the exit line.
5. Repeat exercise starting at either end of the exercise to gain practice in both left and right offsets of the exercise.
6. Repeat exercise as proficiency develops the exercise markers should be decreased to setting B. and then C.

Observation

The instructor should note and immediately correct the following errors:

Improper Starting Position

The student fails to properly align the tractor-trailer and aim it at its intended target.

Failure to Adjust Mirrors

The student fails to adjust his/her mirrors before starting the maneuver.

Improper Coordination of Vehicle Controls

Jerky, abrupt acceleration, and stalling are signs that the student is not able to smoothly coordinate the basic vehicle controls.

Improper Speed Control

Approaches the problem too fast, changing speeds, or braking during the maneuver are errors indicating poor speed control.

Improper Mirror Usage

Opening the door to look out or failing to recognize when steering adjustments should be made indicate errors in mirror usage.

Improper Steering Control

Oversteering
The student makes too frequent steering adjustments, such as making a steering adjustment too soon and then immediately making a corrective action.

Making Adjustments Too Late
The driver makes the steering adjustment too late. If the tractor-trailer gets too far off the correct path, the driver will have to pull out of the exercise and start all over again. Driver should be coached before this occurs.

Making Improper Steering Adjustments
The student turns the wheel prematurely to adjust the trailer's path or, too much, or not soon enough. Or does not allow the vehicle to get back in line once the adjustment has been made, i.e., doesn't straighten out the steering wheel fully.

Evaluation

Student performance will be evaluated against the following criteria:

Proper positioning of the vehicle for the intended path of travel
Ability to recognize when adjustments are needed
Steering technique for making adjustments to vehicle position
Management of vehicle speed for amount of space available
Makes two or less barricade touches or hits
Does not use excessive time for exercise
    Setting A--120 seconds
    Setting B--100 seconds
    Setting C--90 seconds

3. ALLEY DOCK EXERCISE (6 hours)

NOTE: Students have practiced sight side alley dock with wider dimensions at least once in Unit 1.6.

Purpose

The purpose of this exercise is to develop student ability to back a tractor-trailer into a limited space at a simulated dock and to stop the vehicle within a specified distance of the dock. The exercise is used for student practice to enable them to develop proficiency toward the standards required in the Pre-Street Range Test.

Range Layout

Street length - approximately 200 feet (depending on vehicle)

Alley dock width:
Setting A--12 feet 10 inches wide alley, 20 feet deep
Setting B--12 feet 3 inches wide alley, 20 feet deep
Setting C--11 feet 8 inches wide alley, 20 feet deep
See Range Diagram, Exercise 3 (at end of this lesson)

Directions

1. Instructor will demonstrate the exercise (5 minutes).

2. Students will rotate from behind-the-wheel to posts on the range to observe, record and assist with the exercises.

3. Students will enter the simulated street and staying within the street boundaries will come to a stop opposite the alley dock with vehicle in proper position to back into the dock.

4. The exercise will be performed using two different maneuvers - backing in from the sight and backing in from the blind side. Although blind side backing is taught and practiced by students for the experience it provides, they will only be tested on sight side backing.

5. Student(s) observers are required to act as driver's helpers (swampers) whenever blind side backing maneuvers are being practiced.

6. Drivers must stop the vehicle when the trailer is within 24 inches (or less) from the rear barricade (simulated dock) without actually touching the dock. As proficiency increases, the objective shall be to stop within 12 inches (or less) from the dock without actually touching it.

7. The maneuvers ends when the vehicle comes to a complete stop within the alley and the driver blows the horn to signal that he/she is ready for the measurement to be taken of the distance from the rear of the trailer to the rear barricade (dock).

8. Once student proficiency is developed with the alley dock width at setting A. the dock width shall be decreased to setting B. and then to setting C.

Observation

Instructors should note and immediately correct the following errors:

Improper Starting Position

The student fails to properly align the tractor-trailer and iam it at its intended target.

Failure to Adjust Mirrors

The student fails to adjust his/her mirrors before starting the backing maneuver.

Improper Coordination of Vehicle Controls

Jerky, abrupt acceleration, and stalling are signs that the student is not able to smoothly coordinate the basic vehicle controls when backing.

Improper Speed Control

Backing too fast, changing speeds, or braking during the backing maneuver are errors indicating poor speed control.

Improper Mirror Usage

Opening the door to look out or failing to recognize when steering adjustments should be made indicate errors in mirror usage.

Improper Steering Control

Oversteering
The student makes too frequent steering adjustments, such as making a steering adjustment too soon and then immediately following up with a corrective action.

Making Adjustments Too Late
The driver makes the steering adjustment too late. If the tractor-trailer gets too far off the correct path, the driver will have to pull up and start again. Driver should be coached to "jack" the vehicle before this occurs.

Making Improper Steering Adjustments
The student turns the wheel in the wrong direction to adjust the trailer's paths or "jacks" the vehicle too hard, too much, or not soon enough. Or does not allow the vehicle to get back in line once the adjustment has been made, i.e., doesn't straighten out the steering wheel.

Evaluation

Student performance wil be evaluated against the following criteria:

- Positions vehicle correctly before backing
- Uses correct steering techniques for completing the maneuver
- Does not strike exercise markers or go outside boundary of exercise
- Does not need excessive pullups to complete maneuver
- Stops within 24 inches (or less) of the simulated dock (rear barricade) without striking it or touching it (Pre-Street Test requirement)
- Makes only the one stop (doesn't move forward or back) once he/she is within the dock and has sounded the horn for student observer(s) or instructor to take measurement (from rear barricade to rear of the trailer)
- Does not exceed time for exercise
  - Setting A--5 minutes, 30 seconds
  - Setting B--5 minutes
  - Setting C--4 minutes, 30 seconds

4. ALLEY DOCK - JACKKNIFED EXERCISE (6 hours)

NOTE: Students have practiced sight side alley dock with wider dimensions at least once in Unit 1.6

Purpose

The purpose of this exercise is to develop student ability to back a tractor-trailer into a limited dock space, in a situation that simulates a limited space for parking a tractor-trailer at an alley dock which requires that the tractor be left at a 90 degree angle to the trailer while loading/unloading. The exercise is used to provide student practice to enable them to develop proficiency toward the standards required in the Pre-Street Range Test.

Range Layout

Street length - approximately 200 feet (depending on vehicle)

Street width - 50 feet

Alley dock width:

Setting A--12 feet 10 inches wide alley, 10 feet deep
Setting B--12 feet 3 inches wide alley, 10 feet deep
Setting C--11 feet 8 inches wide alley, 10 feet ddeep
See Range Diagram, Exercise 4 (at end of this lesson)

Directions

1. Instructor will demonstrate the exercise (5 minutes)

2. Students will rotate from behind-the-wheel to posts on the range to observe, record and assist with the exercise.

3. Students will enter the simulated street and staying within the street boundaries will come to a stop opposite the alley dock with vehicle in proper position to back into the dock.

4. The exercise will be performed using two different maneuvers - backing in from the sight side and backing in from the blind side, in each case ending up with the tractor fully jackknifed when the trailer reaches the dock. Although blind side backing is taught and practiced by students for the experience it provides, they will only be tested on sight side backing.

5. Student(s) observers are required to act as driver's helpers (swampers) whenever blind side maneuvers are being practiced.

6. Drivers must stop the vehicle when the trailer is within 30 inches (or less) from the rear barricade (simulated dock) without actually touching the dock. As proficiency increases, the objective shall be to stop within 18 inches (or less) from the dock without actually touching it.

7. The maneuver ends when the vehicle comes to a complete stop within the alley and driver blows horn to signal that he/she is ready for the measurement to be taken of the distance from the rear of the trailer to the rear barricade (dock). At the same time, the tractor must be in a fully jackknifed position, that is, at a 90 degree angle to the trailer.

8. Once student proficiency is developed with the alley dock width at setting A. the dock width shall be decreased to setting B. and then to setting C.

Observation

Instructors should note and immediately correct the following errors:

Improper Starting Position

The student fails to properly align the tractor-trailer and iam it at its intended target.

Failure to Adjust Mirrors

The student fails to adjust his/her mirrors before starting the backing maneuver.

Improper Coordination of Vehicle Controls

Jerky, abrupt acceleration, and stalling are signs that the student is not able to smoothly coordinate the basic vehicle controls when backing.

Improper Speed Control

Backing too fast, changing speeds, or braking during the backing maneuver are errors indicating poor speed control.

Improper Mirror Usage

Opening the door to look out or failing to recognize when steering adjustments should be made indicate errors in mirror usage.

Improper Steering Control

Oversteering
The student makes too frequent steering adjustments, such as making a steering adjustment too soon and then immediately following up with a corrective action.

Making Adjustments Too Late
The driver makes the steering adjustment too late. If the tractor-trailer gets too far off the correct path, the driver will have to pull up and start again. Driver should be coached to "jack" the vehicle before this occurs.

Making Improper Steering Adjustments
The student turns the wheel in the wrong direction to adjust the trailer's paths or "jacks" the vehicle too hard, too much, or not soon enough. Or does not allow the vehicle to get back in line once the adjustment has been made, i.e., doesn't straighten out the steering wheel.

Evaluation

Student performance will be evaluated against the following criteria:

Positions vehicle correctly before backing
Uses correct steering techniques for completing the maneuver
Does not strike exercise markers or go outside boundary of exercise
Does not need excessive pullups to complete maneuver
Finishes with the tractor jackknifed (at a full 90 degree angle to the trailer)
Stops within 30 inches (or less) of the simulated dock (rear barricade) without striking it or touching it (Pre-Street Test requirement)
Makes only one stop (doesn't move forward or back) once he/she is within the docks and has sounded the horn for student observer(s) or instructor to take measurement (from rear barricade to rear of the trailer)
Does not exceed time for exercise
    Setting A--5 minutes, 30 seconds
    Setting B--5 minutes
    Setting C--4 minutes, 30 seconds

5. SERPENTINE - FORWARD AND REVERSE EXERCISES (6hours)

NOTE: Students will have practiced the forward serpentine exercise at least once in Unit 1.4 at dimensions wider than those in Exericse 2.

Purpose

The purpose of the exercise is to develop the ability to maneuver the vehicle in limited space and to develop proficiency toward the standards required in Pre-Street Range Test.

Range Layout

Street length - approximately 320 feet (depending on vehicle)

Street width - 50 feet, plus width of th drums, i.c., 25 feet required from edge of the drums to the street boundary on each side

Obstacles - 3 required, each obstacle is made from a pair of 55 gallon oil drums (one on top of the other) and butt welded end to end

Distance between obstacles - 75 feet from the starting line to the first obstacle and 130 feet from last obstacle to the stop line (these 2 distances remain constant)
    Setting A-- 58 feet, 6 inches (edge to edge) between each obstacle (pair of drums)
    Setting B--55 feet, 6 inches (edge to edge)
    Setting C--53 feet, 0 inches (edge to edge)

See Range Diagram, Exercise 5 (at end of this lesson)

Directions

1. Instructor will demonstrate exercise (5 minutes).
2. Students will rotate from behind-the-wheel to posts on the range to observe, record and assist with the exercise.
3. Students will enter the simulated street from the starting line and will then drive to the right of the first drum, to the left of the second drum and to the right of the third drum and come to a stop when front bumper of tractor reaches the stop line.
4. Students will then shift to reverse gear and back through the exercise in a reverse pattern i.e., back to left of the first drum, right of the second drum and left of the third drum and continue backing until front bumper of the tractor clears the start line of the exercise.
5. Student(s) observers are required to be alert at all times to stop the driver if he/she is in danger of backing over an obstacle and/or to move an obstacle if a driver is unable to clear it due to a steering error.
6. Once stduent proficiency is developed with the distance between the 3 drums at setting A. the distance shall be decreased to setting B. and then to setting C.

Observation

Instructors should note and immediately correct the following errors:

Improper Starting Position

The student fails to properly align the tractor-trailer and aim it at its intended target.

Failure to Adjust Mirrors

The student fails to adjust his/her mirrors before starting the backing maneuver.

Improper Coordination of Vehicle Controls

Jerky, abrupt acceleration, and stalling are signs that the student is not able to smoothly coordinate the basic vehicle controls when backing.

Improper Speed Control

Going forward or backing too fast, changing speeds, or braking during the maneuver are errors indicating poor speed control.

Improper Mirror Usage

Opening the door to look out or failing to recognize when steering adjustments should be made indicate errors in mirror usage.

Improper Steering Control

Oversteering
The student makes too frequent steering adjustments, such as making a steering adjustment too soon and then immediately following up with a corrective action.

Making Adjustments Too Late
The driver makes the steering adjustment too late. If the tractor-trailer gets too far off the correct path, the driver will have to pull up and start again. Driver should be coached to "jack" the vehicle before this occurs.

Making Improper Steering Adjustments
The student turns the wheel in the wrong direction to adjust the trailer's paths or "jacks" the vehicle too hard, too much, or not soon enough. Or does not allow the vehicle to get back in line once the adjustment has been made, i.e., doesn't straighten out the steering wheel.

Evaluation

Student performance will be evaluated against the following criteria:

- Makes timely and accurate steering corrections to maneuver around the exercise obstacles
- Does not touch or hit drums or go outside of simulated street boundary delineators
- Does not exceed requirements for motion control
  - Going Forward - no changes in direction or stops allowed
  - Going Backward - makes 4 (or less) changes in direction or stops
- Does not exceed time for exercise
  - Setting A--Forward, 120 seconds; backward, 5 minutes
  - Setting B--Forward, 90 seconds; backward, 4 minutes, 30 seconds
  - Setting C--Forward, 60 seconds; backward, 4 minutes

6. PARALLEL PARKING - JACKKNIFED EXERCISE (6 hours)

NOTE: Students will have practiced this maneuver at least on ce in Unit 1.6.

Purpose

The purpose of this exericse is to develop and demonstrate the ability to parallel park a tractor-trailer in a jackknifed position (tractor at 90 degree angle to the trailer) and to develop proficiency toward the standards required in the Pre-Street Range Test.

Range Layout

Street length - approximately 200 feet (depends on length of vehicle)

Street width - 40 feet

Parking space width (at curb) - 8 feet, 6 inches

Parking space length
    Setting A--exact length of trailer, plus 8 feet
    Setting B--exact length of trailer, plus 7 feet
    Setting C--exact length of trailer, plus 6 feet
See Range Diagram, Exercise 6 (at end of this lesson)

Directions

1. In this exercise it is best to disconnect air lines to the trailer (drain the trailer air reservour to release brakes) in order to avoid damage to the tractor air lines and/or gladhands.

2. Instructor will demonstrate the exercise (5 minutes)

3. Students will rotate from behind-the-wheel to posts on the range to observe, record and assist with the exercise.

4. Students will enter the simulated street from the entrance end so that the curb parking space is to the right of their vehicle. They will then pull past the exercise and stop with the vehicle in a proper position to back into the curb space between the 2 parked vehicles, which are simulated with 2 barricades each of which is set at right angles to the curb. The barricades will extend out intothe simulated street for a distance of 8 feet, 6 inches.

5. The exercise will be performed by backing the vehicle into the curb space so that the trailer is parallel to the curb and the tractor is jackknifed (at a 90 degree angel to the trailer).

6. Student(s) observers must act as driver's helpers (swampers) during this maneuver to prevent equipment damage.

7. Drivers must stop the vehicle with the trailer completely parallel to the curb and with the trailer 24 inches (or less) from the curb. As proficiency increases, the objective shall be to stop within 18 inches (or less) of the curb, again without touching or hitting it.

8. The maneuver ends when the vehicel comes to a stop within the curb space and the driver blows the horn to signal that he/she is ready for the measurement to be taken of the distance from the side of the trailer to the curb. Measurements must be taken at the front, middle and rear of the trailer and the longest distance shall be the one that shall be regarded as the driver's "distance".

9. Once student proficiency is developed with the curb space at setting A. the available curb space shall be shortened to setting B. and then to setting C.

Observation

Instructors should note and immediately correct the following errors:

Improper Starting Position

The student fails to properly align the tractor-trailer and iam it at its intended target.

Failure to Adjust Mirrors

The student fails to adjust his/her mirrors before starting the backing maneuver.

Improper Coordination of Vehicle Controls

Jerky, abrupt acceleration, and stalling are signs that the student is not able to smoothly coordinate the basic vehicle controls when backing.

Improper Speed Control

Going forward or backing too fast, changing speeds, or braking during the maneuver are errors indicating poor speed control.

Improper Mirror Usage

Opening the door to look out or failing to recognize when steering adjustments should be made indicate errors in mirror usage.

Improper Steering Control

Oversteering

The student makes too frequent steering adjustments, such as making a steering adjustment too soon and then immediately following up with a corrective action.

Making Adjustments Too Late

The driver makes the steering adjustment too late. If the tractor-trailer gets too far off the correct path, the driver will have to pull up and start again. Driver should be coached to "jack" the vehicle before this occurs.

Making Improper Steering Adjustments

The student turns the wheel in the wrong direction to adjust the trailer's paths or "jacks" the vehicle too hard, too much, or not soon enough. Or does not allow the vehicle to get back in line once the adjustment has been made, i.e., doesn't straighten out the steering wheel.

Evaluation

Student performance will be evaluated against the following criteria:

- Uses correct steering technique
- Makes 4 (or less) changes in direction or stops
- Does not touch or hit "parked vehicles" (simulated with the barricades)
- Makes 2 (or less) curb touches
- Does not cross over (or climb) the curb with trailer wheels
- Does not exceed allowabel distance from curb
  - Trailer parallel and not more than 24 inches from curb - throughout the length of trailer(in-course)
  - Trailer parallel and not more than 18 inches from curb - throughout length of trailer (end-of-course)
- Does not exceed time for exercise
  - Setting A-- 5 minutes
  - Setting B--4 minutes, 30 seconds
  - Setting C--4 minutes

7. CONTROLLED STOP LINE EXERCISE (NO SPECIFIC TIME ALLOCATION)

Purpose

The purpose of this exercise is to develop student ability to stop smoothly at a predetermined point and to develop proficiency towards the standards required in the Pre-Street Range Test.

Range Layout

Stop line should be marked at beginning and ending point of all other exercises or at least one or two of them.

Dimensions of line, 3 to 4 inches wide and at least 10 feet long.

See Range Diagrams for all other exercises (at end of this lesson)

Directions

1. Instructor demonstrates exercise at least once when demonstrating other exercises.

2. This exercise shall be incorporated into all other exercises and student will assist with observation and recording this activity as specified for all other exercises.

3. The exercise will be performed using two different maneuvers - stopping with the front bumper as close as possible to the starting line of an exercise and stopping with the rear (trailer) bumper as close as possible to the exit/stop line. Although the trailer bumper stop will be practiced to give students experience, they will only be tested on stops for the front (tractor) bumper.

4. Drivers must stop the vehicles with the front bumper within 24 inches (or less) of the stop line (without actually going over the line) at thestart of each exercise. As drivers leave an exercise they shall continue past the exit line until the rear (trailer) bumper has actually cleared the exit line and then stop with the bumper within 30 inches (or less) of the line.

5. The objective shall be to make a smooth controlled stop with a single brake application only. Once stopped, the horn shall be blown to signal that the driver is ready for the measurement to be taken. Driver shall not move the vehicle until measurement has been recorded and permission given to move again.

6. Once student proficiency is developed at the above distances, the required stopping distance shall be reduced as follows:

   Tractor front bumper
      24 inches down to 20 inches
      20 inches down to 18 inches
      18 inches down to 16 inches
   Trailer rear bumper
      30 inches down to 28 inches
      28 inches down to 24 inches

Observation

Instructors should note and immediately correct the following errors:

Failure to Adjust Mirrors

The student fails to adjust the mirrors before starting the backing maneuver.

Improper Coordination of Vehicle Controls

Jerky, abrupt braking, and stalling are signs that the student is not able to smoothly coordinate the basic vehicle controls when stopping. A tractor front bounce (nose rebound) or the sound of air being exhausted from the brake system are indiciative of impropoer modulation of the treadle brake valve.

Improper Speed Control

Approaching the line too fast or too slow, or changing speeds, during the maneuver are errors indicating poor speed control.

NOTE: Tractors used in this exercise should be equpped with an air brake application pressure guage to aid students in learning smooth stopping techniques.

Evaluation

Student performance will be evaluated against the following criteria:

Completes maneuver with a smooth, controlled stop
Makes a single treadle valve application, that is properly modulated to bring the vehicle to a complete halt at the desired stopping point
Above items are evidenced by lack of tractor nose rebound and/or the sound of air being exhausted from the brake system
Does not exceed distance for exercise
Student level A--front bumper 24 inches or less from line
Student level B--front bumper 20 inches or less from line
Student level C--front bumper 18 inches or less from line

NOTE: On setting C. the approach should be at least 100 foot long and approach speed should be between 8 and 10 mph at start of the approach i.e., when passing the single traffic cone marking the start of the "approach run".

8. OVERHEAD CLEARANCE EXERCISE (4 hours)

Purpose

The purpose of this exercise is to help students develop the ability to judge amount of horizontal clearance the vehicle may have and to develop proficiency towards the standards required in the Pre-Street Range Test.

Range Layout

The layout must provide a method of displayed variance in horizontal clearance. The most commonly used device is a pair of uprights (at least 16 feet high) with an adjustable cross bar (of lightweight easily broken wood) suspended between the uprights. The cross bar is raised or lowered by clotheslines running through two pulleys (one atop each upright). Those students acting as observers raise or lower the cross bar at the request of the student driver. See Range Diagram, Exercise 8.

Directions

1. The instructor reviews the purpose and procedures of the exercise with the students.

2. Students perform the exercise

   Approach the problem and makes a stop at the "starting line" (which is 5 feet from the adjustable cross bar as measured from the front edge of a tractor-cab's roof).
   Makes a judgement with regard to amount of clearance available and calls out his estimation of "Too high," "Too low," or "Just right" to the observer and/or instructor.
   Moves vehicle slowly ahead and stops when the trailer roof is within 12 inches of the cross bar and stops again to check.
   Checks by sticking head out of cab window and looking up over his/her right shoulder.

Proceeds if he/she thinks that the trailer will clear the cross bar with no more than 6 inches to spare (more or less results in a "no score").

Asks for adjustment of the cross bar if they do not think they can clear.

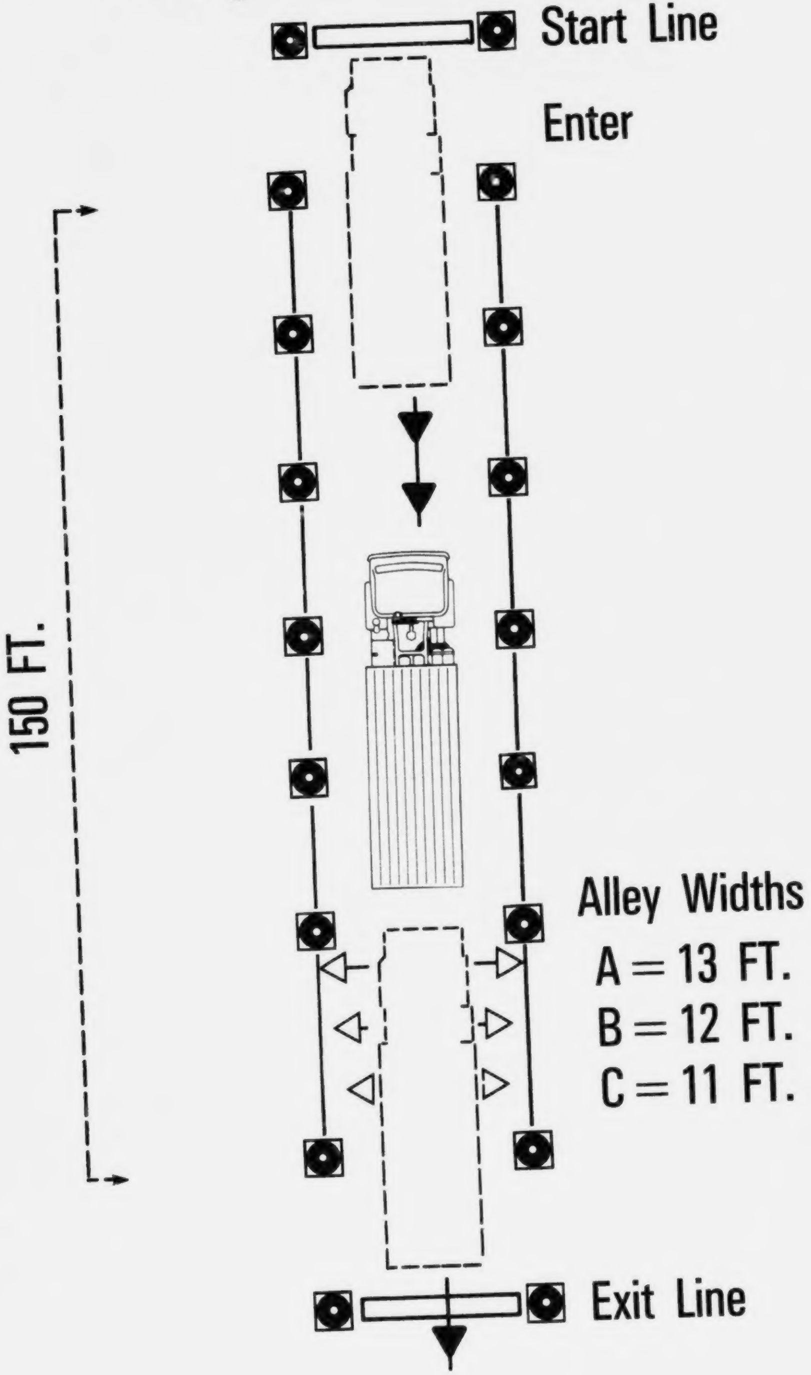
NOTE: This exercise should be done with both conventional and cab-over-engine type tractors and with various height van trailers to enable students to gain practice in clearance judgment.

Evaluation

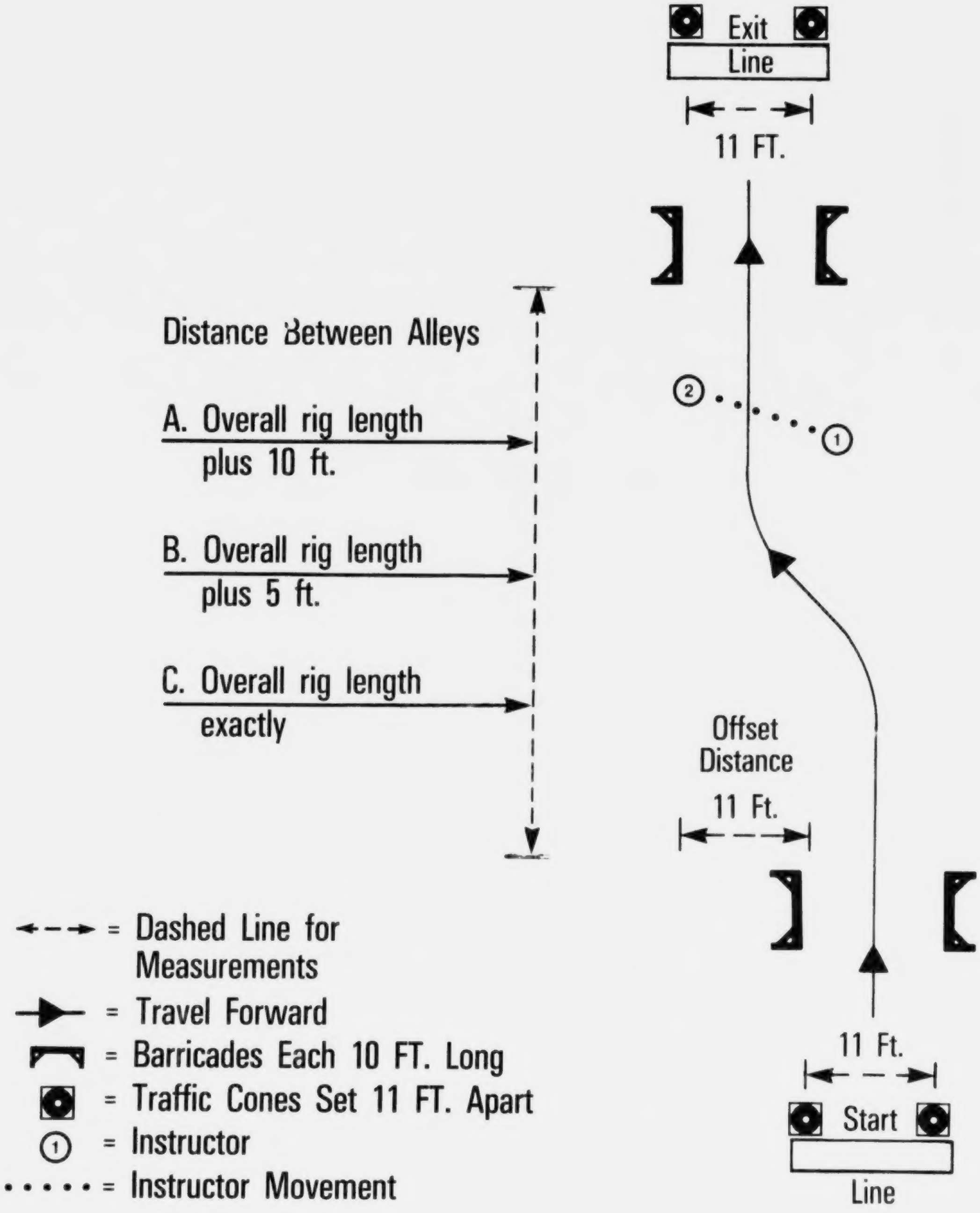
Student performance will be evaluated against the following criteria:

- Ability to correctly judge horizontal clearance
  - Correct--goes under when it is within the required 6 inches, stops; asks for adjustment when not within 6 inches
  - Error--Goes under when not within the required 6 inches, asks for adjustment when it is within the 6 inches
  - Does not exceed time for exercise
    - Student level A--110 seconds
    - Student level B--100 seconds
    - Student level C-- 90 seconds

Straight Line Backing

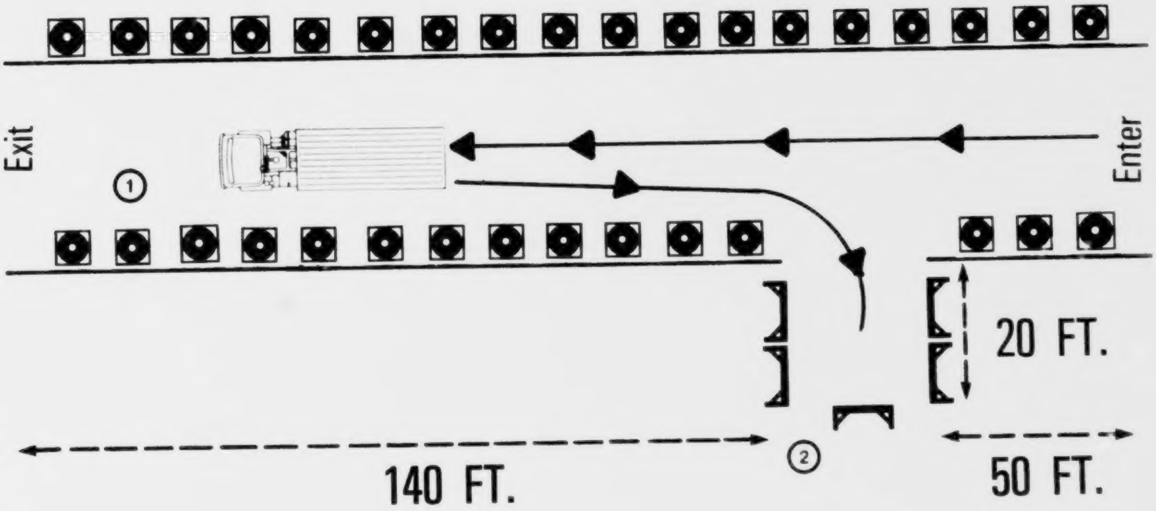

Start Line
Enter
150 FT.
Alley Widths
A = 13 FT.
B = 12 FT.
C = 11 FT.
Exit Line

Range Diagram
Exercise 2–Offset Alley


Exit
Line
11 FT.
Distance Between Alleys
A. Overall rig length plus 10 ft.
B. Overall rig length plus 5 ft.
C. Overall rig length exactly
②
①
Offset Distance
11 Ft.
11 Ft.
Start
Line
= Dashed Line for Measurements
= Travel Forward
= Barricades Each 10 FT. Long
= Traffic Cones Set 11 FT. Apart
① = Instructor
• • • • • = Instructor Movement

Range Diagram
Exercise 3–Alley Dock

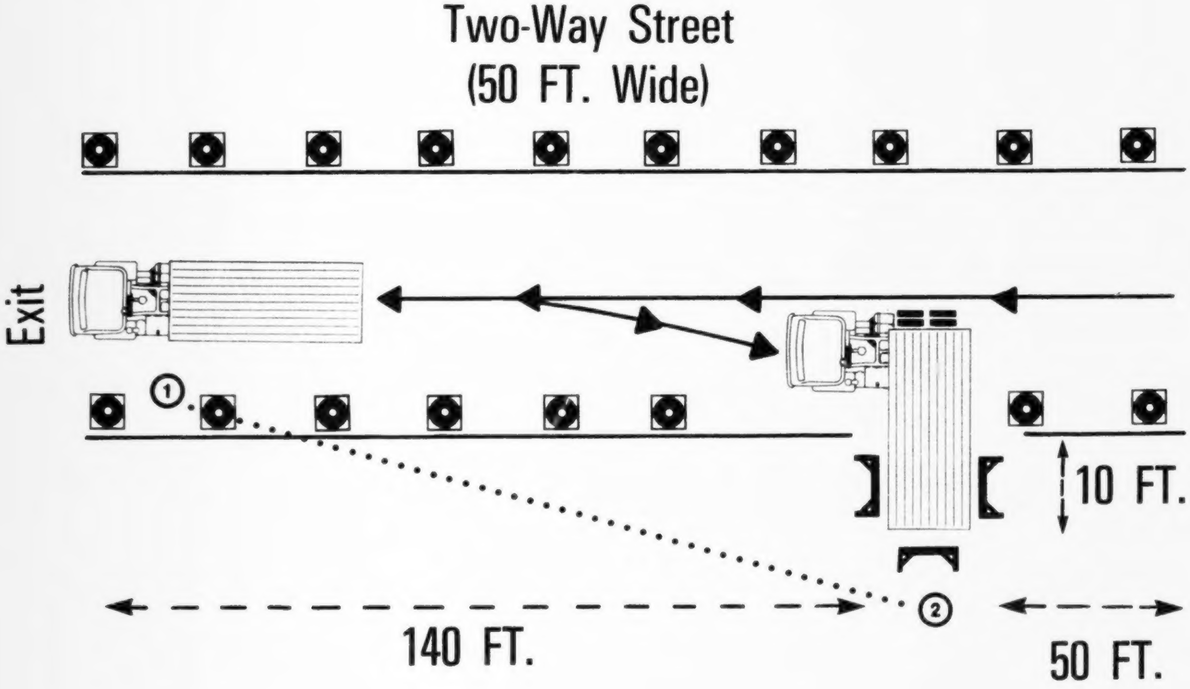
Two-Way Street
(50 FT. Wide)


Exit
Enter
①
②
20 FT.
140 FT.
50 FT.

Dock Widths
A=12 FT., 10 IN.
B=12 FT., 3 IN.
C=11 FT., 8 IN.

—▶— = Travel Forward
⊓ =Barricades (4) Each 10 FT Long
● =Traffic Cones Set 10 FT. Apart
① =Instructor Position
••••• =Instructor Movement
- - - = Dashed Line for Measurements

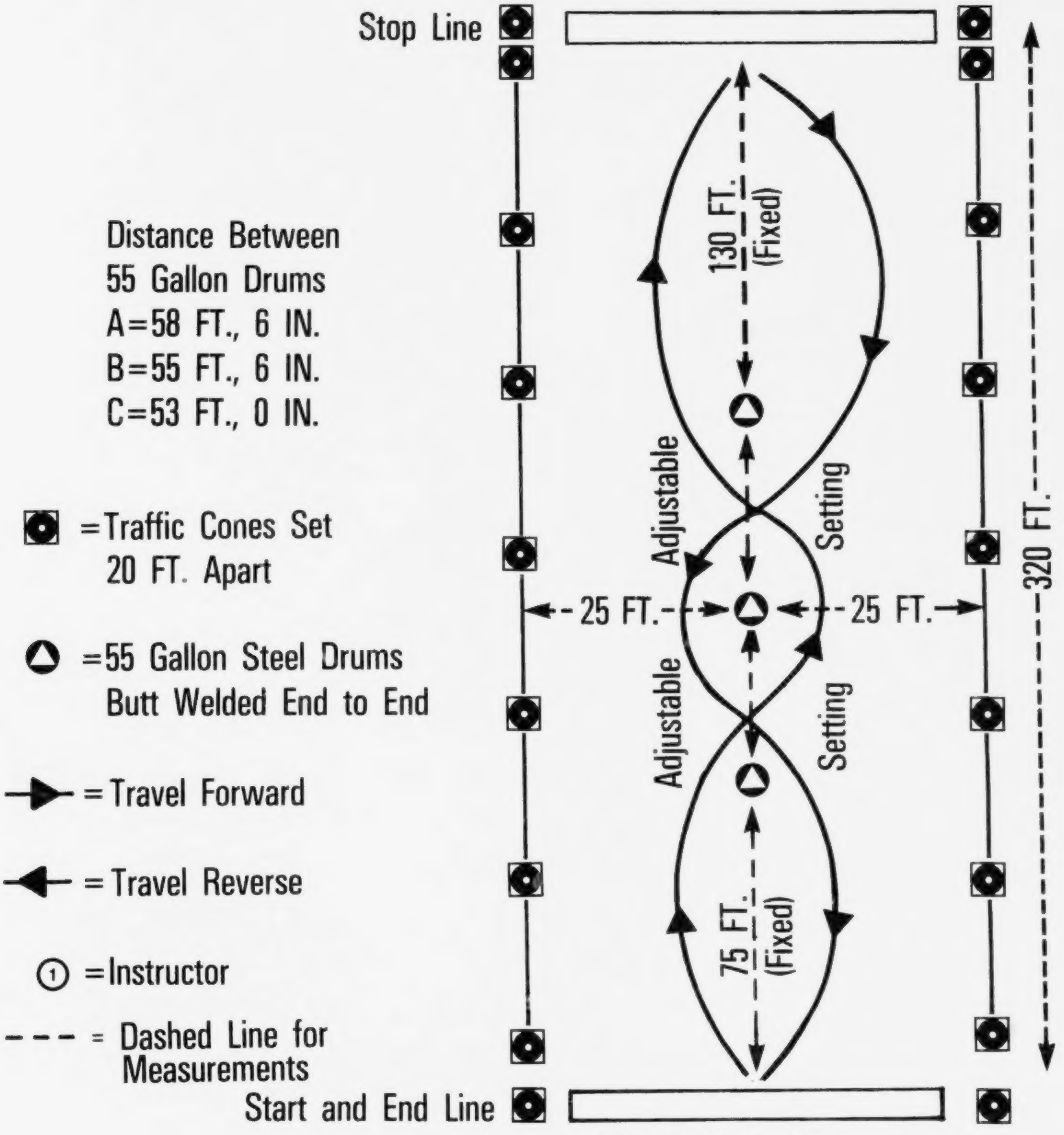
Range Diagram
Exercise 4–Alley Dock–Jackknifed


Two-Way Street
(50 FT. Wide)
Exit
①
②
10 FT.
140 FT.
50 FT.

Dock Widths
A=12 FT., 10 IN.
B=12 FT., 3 IN.
C=11 FT., 8 IN.

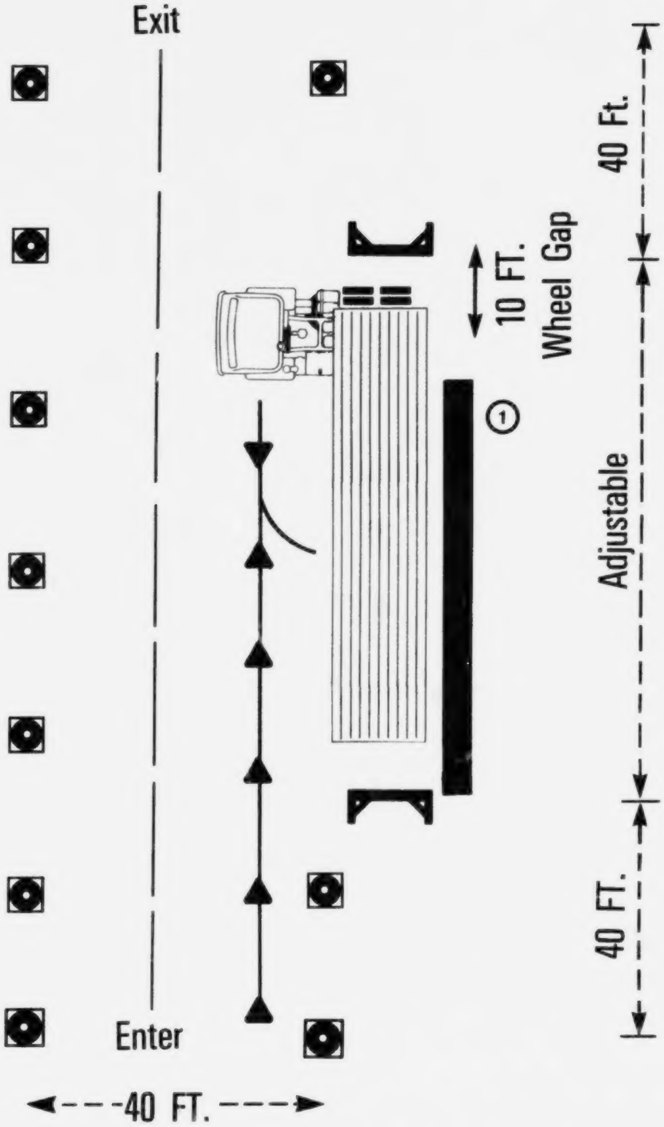
⊓ = Barricades
▣ = Traffic Cones Set 20 FT. Apart
① = Instructor Position
··· = Instructor Movement
◄ = Travel Forward
► = Travel Reverse
←--→ = Dashed Line for Measurements

Range Diagram Exercise 5– Serpentine Forward and Reverse


Stop Line
Start and End Line
130 FT. (Fixed)
75 FT. (Fixed)
Adjustable
Setting
Adjustable
Setting
25 FT.
25 FT.
320 FT.
Distance Between
55 Gallon Drums
A=58 FT., 6 IN.
B=55 FT., 6 IN.
C=53 FT., 0 IN.
▣ =Traffic Cones Set 20 FT. Apart
△ =55 Gallon Steel Drums Butt Welded End to End
→ =Travel Forward
← =Travel Reverse
① =Instructor
- - - = Dashed Line for Measurements

Street Width=25 FT. on
Either Side of 55 Gallon Drums

Range Diagram
Exercise 6–Parallel Parking–Jackknifed


Exit
40 Ft.
10 FT. Wheel Gap
①
Adjustable
40 FT.
Enter
40 FT.

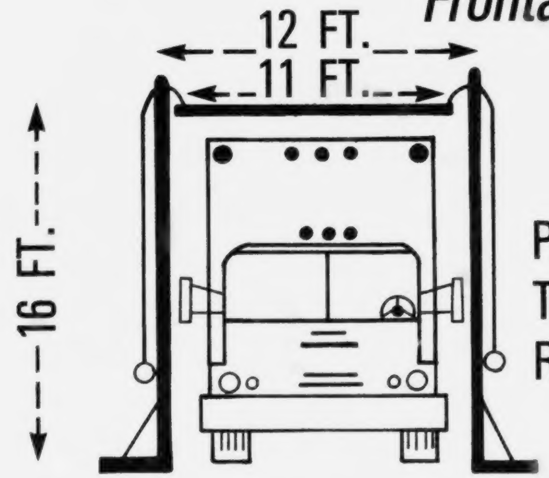
Length of Parking Space Settings

A=Length of Trailer Plus 8 FT.
B=Length of Trailer Plus 7 FT.
C=Length of Trailer Plus 6 FT.

① = Instructor Position
◉ = Traffic Cones Set 20 FT. Apart
⌈⌉ = Barricade 8 FT. 6 in. Long
▬ = Railroad Ties
--- = Dashed Line for Measurements
▲ = Travel Forward
▼ = Travel Reverse

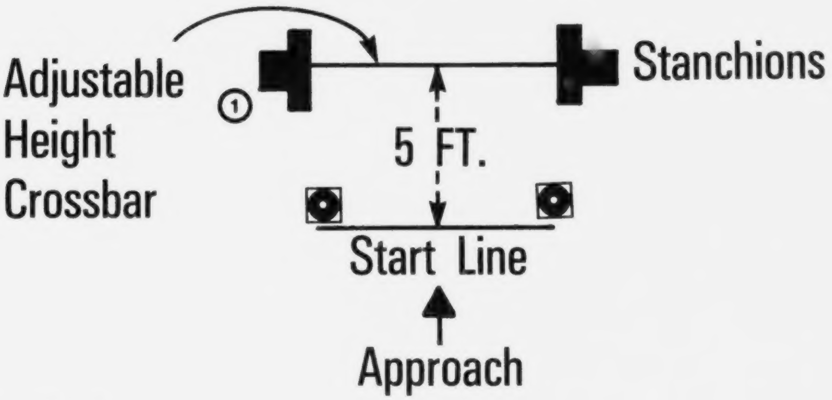
Range Diagram
Exercise 8–Overhead Clearance

Frontal View


12 FT.
11 FT.
16 FT.

Pull Ropes, Each Side, Running Thru Pulley at Top of Posts for Raising or Lowering Crossbar.

Overhead View


Adjustable Height Crossbar
Stanchions
①
5 FT.
Start Line
Approach

◙ = Traffic Cones

① = Instructor

→ = Travel Forward

LESSON 3 PROFICIENCY DEVELOPMENT: PRACTICE IN BASIC CONTROL

Overview

Time Allotted: 18 hours

Prerequisite: Passing score on the Pre-Street Range Test

Purpose:

The purpose of this lesson is to enable students to transfer basic vehicle control skills from the range to street environment under controlled conditions (limited traffic) working in their usual three person teams per vehicle/instructor. Each student will receive a minimum of 3 hours BTW time in low density traffic, followed by an additional 3 hours BTW time in moderate density traffic.

Materials

Instructor Aids

None

Student Material

Road Observer's Checklist, in Unit 1.8 of Student Manual

Rules for Onstreet Driving, in Unit 1.1 of Student Manual

Driver's Duty Status Record (Driver's Daily Logbook) in which to record all driving time and miles as required by this curriculum

NOTE: All students must have a driver's license or learner's permit as may be required by the laws in your State, in their possession at all times when behind-the-wheel in onstreet training lessons.

Instructor Materials

Road Observer's Checklist (at end of previous lesson)

Clipboard with several extra copies of the Range Observer's Checklist

Equipment

Tractor-trailer, 5-axle with van type-trailer, preferably with sliding trailer tandems

Tractor-trailer shall be given a pretrip inspection by students under supervision of the instructor

Tractor must be sleeper berth equipped or have sleeper area modified to accomodate seats for the two observer students

All students and instructor must wear seat belts at all times

Tractor-trailer shall be properly licensed, permitted and insured and "Student Driver" signs displayed (if required in your State).

Instructor's mirror (convex type) shall be mounted on right cab door to allow right rear of trailer to be observed on turns. (Mount mirror below window level to avoid blocking the student driver's view.)

Content

Activity or Topic	Approximate Time
1. STREET OPERATION: LOW-DENSITY ENVIRONMENT	9 hours
2. STREET OPERATION: MODERATE-DENSITY ENVIRONMENT	9 hours
	18 hours

1. STREET OPERATION: LOW DENSITY ENVIRONMENT (9 hours)

Purpose

The purpose of this lesson is to provide students an opportunity to gain the proficiency and confidence needed in coping with the highway traffic enviornment under low-density traffic conditions.

Routes

The routes selected for this lesson should provide students an opportunity to practice basic vehicle operation with a minimum of stress from roadway and traffic conditions. The following requirements should be fulfilled to the extent possible.

Environment

Suburban areas are generally most appropriate. Rural areas are acceptable if accessible to the school. Urban areas with heavy traffic, should be avoided at this stage.

Density

This lesson should begin on routes with virtually no other traffic, progressing to routes that provide a limited amount of traffic.

Situations

The routes selected should expose drivers to controlled and uncontrolled intersections, freeway interchanges, hills and long grades.

Directions

In addition to the general practices for onstreet sessions described in the Introduction of this manual, this lesson will employ the following procedures:

Duration

The duration of actual driving should be limited to 10 to 15 minutes at first. Most students will be nervous about operating in traffic and will therefore tire quickly. Rotating students frequently is important to maintaining a high level of learning and safety.

Maneuvers

Students should be directed to perform the following maneuvers:

- Left and right turns
- Lane changes
- Negotiating curves

Observers

Observer students should be required to fill out the Road Observer's Checklists provided in their Student Manuals.

Critiques

Instructors and observers will provide critiques as described in the Introduction section of this manual.

Assistance

To allow students to concentrate their attention upon vehicle handling, instructors should provide assistance to the students by

reminding them to shift gears when necessary.
reminding them to signal and cancel signals.
warning them as to potential hazards, excess speed, insufficient clearance and safety margins.
directing them around areas of congestion, low overhead or lateral clearance, reversible traffic lanes, and potential hazards from other road users.

Weather

Students should experience their first street lesson under favorable weather conditions.

Observations

Instructor and student observers should note and record errors in basic vehicle control using checklists provided. Errors to be recorded are as follows:

Acceleration

Jerky, abrupt accelerations, both from a standing start and when increasing speed.

Braking

Smooth, controlled stop, no rebound of front end or sound of exhausting air

Stopping Point

Coming to a stop beyond the stop line or other designated stopping point.

Upshifting

Stalling
Operating out of the designated rpm range
Lugging
Slipping the clutch
Waiting too long to shift up

Delayed shift between gears (losing too many rpm)
Missed shift (having to drop back into another gear)
Gear clash

Downshifting

Allowing engine speed to exceed or fall short of designated rpm range
Gear/engine mismatch resulting in lurch as clutch is released
Delayed shift
Over or under revving between gears
Gear clash

Uphill Operation

Lugging (failure to shift soon enough)
Excessive loss of speed
Roll back when starting from a standing point

Starting on an Incline

Improper coordination of parking brake, footbrake, and throttle resulting in one or more of the following:

Rolling back
Stalling the engine
Excessive clutch slipping, particularly at high RPM

Downhill Operation

Starting down the hill in too high a gear
Failing to maintain steady brake pressure (e.g., fanning)

Speed Adjustment/Curves

Excessive speed in entering turn or at an intersection, is indicated by

sharp lateral acceleration
braking while in the curve or turn

Lane-Keeping/Straight

Touching or crossing lane marking when operating in a straight line

Lane-Keeping/Curve

Wandering back and forth between lines or touching or crossing lane marking while in curve

Lane-Keeping/Turn

Operating outside of the designated lane while in a turn

Right Turn

Right rear wheels cutting across curb or road edge

Left Turn

Beginning left turn too early (cutting across lanes approaching from the left)

Curves

Wheels not kept within lane markings, fails to steer far left/right to compensate for the off-tracking of the trailer

2. STREET OPERATION: MODERATE DENSITY ENVIRONMENT (9 hours)

Purpose

The purpose of this lesson is to permit students to acquire confidence and proficiency in coping with the highway-traffic environment under conditions of moderate traffic.

Routes

The routes selected for this lesson would be similar to those used in the previous lesson except that the areas and hours of the day would be selected to create a moderate amount of traffic.

Directions

The procedure employed in this lesson is identical to that of the previous lesson except for the following:

Duration

The duration of each behind-the-wheel session may be increased to 15-20 minutes.

Assistance

While instructors should be prepared to provide the type of assistance described in the earlier lesson, the student's need for it should decrease.

Observations

The observations made in this lesson and the checklist used would be the same as those used in the previous lesson.

Notes:

UNIT 1.9
SPECIAL RIGS

UNIT 1.9 SPECIAL RIGS

PURPOSE

The purpose of this unit is to introduce students to the characteristics of special rigs, i.e., those different from the standard vehicles taught in this curriculum.

OBJECTIVES

Performance Objectives

Student must be able to

- recognize the most frequently encountered special rigs.
- determine whether they can safely operate any type of special rig.

Knowledge Objectives

Student must know

- the function, operating characteristics, physical dimensions, special features, and hazards of special rigs.
- the hazard of attempting to operate a rig when the driver is not qualified.

Skill Objectives

None

Attitude Objectives

Student must believe that

- special rigs require special qualifications and training.

LESSONS

Lesson 1.	**Characteristics of Special Rigs (Classroom)**	**1 hour**
Lesson 2.	**Observation of Special Rigs (Lab)**	**3 hours 30 minutes***

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* Optional

LESSON 1 CHARACTERISTICS OF SPECIAL RIGS (CLASSROOM)

Overview

Time Allotted: 1 hour

Prerequisites: Unit 1.1

Purpose:

Special rigs are those tractors and trailers which are different from the standard 5-axle, 18 wheel tractor-trailer (with a 40-45 foot van) on which this course is based. The purpose of this lesson is to identify and discuss frequently encountered special rigs and their characteristics. Vehicle descriptions, important characteristics, handling and special requirements will be the main points covered. The basic idea is to introduce students to the wide variety of tractors and trailers in the trucking industry and the need for specialized training.

Materials

Instructional Aids

Visuals 1- 15

Student Material

No additional material required

Instructor Material

Required

Content

Activity or Topic	Approximate Time
1. SPECIAL RIGS	1 hour

1. SPECIAL RIGS (1 hour)

What is a Special Vehicle?

Any combination vehicle that differs from the standard tractor and 40-45 foot dry freight van trailer with 5 axles and 18 wheels, as used for the basic training vehicle in this curriculum.

- Vehicles with more than one point of articulation
- Vehicles that are overlength, overheight, overwidth, and/or overweight
- Vehicles with very low vehicle-to-ground clearances
- Vehicles that, when loaded, have a high center of gravity
- Vehicles with load stability problems
- Vehicles that are used for special cargos
- Vehicles that require special handling

Visual 1 Twin Trailers

Multiple Articulation Vehicles

Twin Trailers (also known as double-bottoms, doubles, or set of joints)

Two basic types, western doubles and turnpike doubles

Western Doubles

- Description
  - Two semi-trailers.
  - Second trailer converted to full trailer using a converter gear
    - A set of wheels with a fifth wheel
    - Second semi-coupled to fifth wheel
  - Connected to first trailer by a pintle hook and eye
    - Pintle hook is on back of first trailer
    - Drawbar and eye is on the end gear of the converter
- Distinguishing Characteristics
  - Points of articulation
    - Doubles have three (normal combination has one)
      - Point 1--First trailer kingpin and fifth wheel
      - Point 2--Pintle hook and eye
      - Point 3--Converter gear fifth wheel and kingpin of second trailer
    - Improves maneuverability
- Other Major Characteristics
  - Trailer length 24-31 feet
  - Overall length 60-75 feet
  - Trailer type--can be tankers, flat beds, dumps, etc.
  - Location--normally used in the Western United States
  - Cargo--diversified
- Handling
  - Regular safe-driving practices for single semi-trailers

Special handling points:
  - Avoid backing--extremely difficult as it is not designed for this
  - Smooth steering required (jerking or whipping wheel is greatly magnified in second trailer)
  - Heaviest trailer must always be in front of lighter one
  - Don't apply brakes in curve (causes second trailer to dip)
  - Be aware of greater length (passing, lane changing, crossing intersections)
  - Can't make tight turns with close coupled rigs
  - Watch out for bumps, potholes, etc., tops of trailers can strike each other
  - Be aware of tracking to stay in lane through curves

Special Requirements

- Driver training--requires increased levels of knowledge and proficiency in handling
- Road use and permits--37 States allow doubles to operate on their highways*
  - In those States, length, weight, permit and road use requirements vary--see individual regulations
- Inspection
  - Drawbar and pintle hook (properly in place and hooked)
  - Safety chains are in place
  - Light cords are attached
  - All air lines hooked properly and all valves opened (or shut as may be required
  - Coupling and uncoupling (see Unit 1.7)

Turnpike Doubles

Description

Same as Western Doubles except for size

Distinguishing Characteristics

- Trailer length - 35 to 40 feet
- Overall length - over 100 feet
- Usually high power engine, multiple gear range transmission

Other Major Characteristics and Handling--same as Western Double

Special Requirements:

- Driver training
  - Requires increased levels of knowledge and proficiency in handling
  - Requires special driver's license to operate
- Road use and permits--can be operated only with special permit on designated toll roads (see individual State regulations)
- Inspection--basically same as Western Doubles
  - Toll road authority often requires special procedures that are more stringent

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*This now changing as this manual goes to press

Visual 2 Triple Trailers

Triple Trailers
(Also called triples, triple headers, triple bottoms or set of joints)

- Description
  - Three semi-trailers
  - Second and third converted to full trailers using converter gear
  - Connected by drawbar and pintle hook
- Distinguishing Characteristics
  - (Student should be able to identify the five points from the previous discussion of doubles:
    - 3 kingpin-fifth wheel connections
    - 2 eye-pintle-hook connections
  - Trailer length - 27 feet
  - Other major characteristics and handling--same as doubles
- Special Requirements
  - Driver training
    - Requires increased levels of knowledge and proficiency in handling
    - Requires special license in some States
  - Road use and permits--operated only in far western States with special permit on designated highways (see individual State regulations)
- Inspection--same as doubles

Visual 3 B-Trains

B-Trains

- Description
  - Two semi-trailers
    - First trailer
      - Tandem rear axles are to the rear of the trailer body so second axle is under the nose of second semi-trailer
      - Fifth wheel mounted above second axle (eliminates the need for converter gear)
    - Second trailer
      - Couples to first using fifth wheel described above (eliminates one point of articulation)
- Distinguishing Characteristics
  - Points of articulation.
    - B-trains have two (doubles have three, normal combination one)
  - Position of rear tandem axles (first trailer)
    - Tandem rear axles moved so second axle is behind the body of first trailer (normally both axles are under trailer)

Other Major Characteristics

Trailer and overall length--will vary depending on State or province operated in (e.g., two 40-foot trailers, one 40-foot and one 27-foot trailer, etc).

Trailer type--can be vans, tankers, flat beds, dumps, etc.

Location--normally used in Canada; however, starting to catch on in United States

Cargo--diversified

Handling

Regular safe-driving practices for normal combinations apply

Special handling points:

Avoid backing--difficult (however, easier than backing regular doubles)

Smooth steering required (jerking or whipping wheel is magnified in second trailer)

Need to be aware of greater length (passing, lane changing, crossing intersections, etc.)

Need to be aware of tracking in order to stay in lane through curves

Special Requirements

Driver training

- Requires increased levels of knowledge and proficiency in handling
- Requires special license in all States

Road use and permits--operated with special permit on designated highways (see individual State regulations)

Visual 4 Special Trailer Types (Oversized Loads)

Oversized Vehicles

Description

Trailer types include lowbeds, drop frames, flat beds, and open top vans

Many wheels and axles (depends on actual weight, size of cargo, and State regulations)

Many equipped with outriggers to support oversized loads

Converter gears attached to trailer or tractor by fifth wheel/king-pin or attached to cargo itself (distributes weight over more axles and/or supports longer loads).

Use

Designed to haul cargo which is
- Overdimensional
- Overweight

Such as
- Power plants (nuclear reactors)
- Industrial dryers (chemical plant soda ash dryer)
- Heavy construction equipment (cranes, earth movers, etc.)

Special Requirements

- Driver training
  - Requires increased levels of knowledge and proficiency in handling
  - Usually requires special license
- Road use and permits
  - Usually operated with special permit (depends on size and weight of load) on designated highways (see individual State regulations)
- Inspection and securement
  - Requirements will vary depending on type of cargo, size, and State regulations

EXAMPLES:

- 2-axle double drop lowbed with outriggers
  - Double drop frame
  - 2 rear trailer axles
  - Outriggers (attached to each side of trailer when extended, support a wider load)
- 5-axle removable gooseneck low bed with detachable 2-axle dolly
  - Low bed frame
  - 3 rear trailer axles
  - 2-axle dolly attached to rear of trailer
  - Detachable gooseneck (allows trailer to rest on ground for loading heavy equipment, e.g., bulldozers, end loaders, etc.
- Custom trailer and dolly for hauling large diameter and long commodities
  - Drop frame
  - 2 rear axles
- 4-axle dolly attached to trailer using the actual cargo itself (e.g., one end of cargo rests on dolly, the other end on the trailer)
- 2-axle float
  - Flat bed frame.
  - 2 rear trailer axles (used primarily in oil fields for hauling drilling equipment, pipes, etc.)
  - Has no landing gear
- 4-axle removable gooseneck lowbed with outriggers
  - Low bed frame
  - 4 rear trailer axles
  - Detachable gooseneck (allows trailer to rest on ground for loading heavy equipment, e.g., bulldozers, cranes, etc.)
  - Outriggers used to support wider loads
- Multi-wheel low bed trailer with jeep dolly
  - Low bed frame
  - 2 rear trailer axles
- 2-axle jeep dolly attached to fifth wheel of tractor (in between tractor and trailer)
- 2-axle extendable low bed trailer
  - Low bed frame (single drop)
  - 2 rear trailer axles
  - Trailer capable of being extended (e.g., closed 40 feet, extended 55 feet)

Visual 5 Low Clearance Vehicles

Low Clearance Vehicles

Two basic kinds, double drop frame and drop frame

Description

- Double drop--frame drops between the kindpin and trailer axles
- Single drop--frame drops right behind kingpin

Use

- Designed to haul heavy oversized cargo (low beds) or to accommodate greater cubic capacity loads (van type trailers)

Special Requirements

- Driver training
  - Requires increased levels of knowledge and proficiency in handling
- Sometimes requires special license
- Road use and permits--depends on trailer type, size and weight of cargo (see individual State requirements)

EXAMPLES: Double Drop Frame

- Low bed (also known as "flat bed", "low boy", or "equipment float")
  - Designed to haul heavy equipment, e.g., bulldozers, cranes, earthmovers, etc.
  - Oversized items, e.g., power plants, boilers, generating stations
  - Can have bottom clearance problems especially at railroad crossings, curbs, large potholes, etc.
  - Trailer may have 4-axles and as many as 24 wheels
  - Additional information can be found in the Oversized Vehicle section
- Warehouse or furniture van
  - Most common van in household goods moving industry
  - Drop-in frame provides greater cubic capacity, e.g., maximum drop of 27 inches adds approximately 3,000 cubic feet of cargo space
  - Generally easier to load because of drop (if hand loading)
  - Wheel housing can create loading problem.
    - Required to accommodate wells for 20-inch wheels
  - Difficult for forklift to pass beween wheel housing
- Electronics vans
  - Designed originally to handle delicate electronic equipment
  - Air ride or soft ride suspension protects load
  - Also used to haul high bulk, low weight commodities, i.e., "balloon freight" such as clothing, potato chips, plastics
  - Drop of 21 inches is smaller than warehouse van
  - No wheel wells so loading problem with wheel housing eliminated

Smaller 15-inch wheels allow for flat floor
Less capacity
More heat buildup in brake drums and tires
Not as much capacity as warehouse van
Capacity not limited by wheel housing area above rear axle

Livestock transport--designed to carry live animals, e.g., cattle, sheep, hogs, etc. (Additional material in Unstable Vehicle section)

Single Drop Frame:
- Low bed (also known as "flat bed")
  - Designed to haul higher loads without exceeding height limitation laws
  - Can have bottom clearance problems (not as bad as double drop frames)
  - Trailers can have many axles and wheels depending on type of load and its weight
  - (Additional material in Oversized Vehicle section).
- Warehouse, furniture or electronics van
  - Can have either a drop or double drop frame design (see Double Drop Frame explanation)

Visual 6 High Center of Gravity Vehicles

High Center of Gravity Vehicles

EXAMPLES: Dry Bulk Tankers

Description
- Semi-trailer, shape varies
  - Usually cylindrical
- May be high on both ends
- Slope to center bottom discharge gate

Uses
- Transportation of dry bulk cargo ranges from flour, sugar, and powdered milk to ground limestone, cement, fly ash, or plastic pellets

Characteristics
- Varying lengths
- Loaded through openings on top
  - Unloaded using a blower mounted on trailer or may get power from tractor power take-off or the engine exhaust system
- Some unload by gravity through bottom of tank

Handling
- Basic handling procedures should be observed
  - Usually have high center of gravity
  - Need to keep speed under control
  - Especially important when negotiating curves and turns

Livestock Transports

Any livestock transport that has been converted to operate with two or three decks has a high center of gravity

Animals riding at top of trailer cause high center of gravity (additional material in Unstable Vehicle section)

Reefers (meat trailer type)

Any meat railer with rails attached to the roof of the trailer used to hang meat for transporting

High hanging meat creates high center of gravity

(Additional material in Unstable Vehicle section)

Oversized Vehicles (with oversized loads)

Any trailer transporting oversized loads with cargo resting abnormally high on trailer will have a high center of gravity problem

EXAMPLE: Drop frame custom trailer and dolly transporting a nuclear reactor (reactor resting on cradles stretched between dolly and trailer)

Visual 7 Examples of Tankers

UNSTABLE LOADS

Liquid Tankers

Description

Semi-trailer--either oval (most common), circular or square shaped

Load/unload mechanisms maybe connected to tractor

Uses

Transportation of liquid cargo

Hot tankers, e.g., asphalt

Cold tankers,e.g., milk, orange juice

Pressurized, e.g., liquified gases

Characteristics

Varying lengths

Compartments (varies from one to many)

May or may not contain baffles (plates to keep liquid from sloshing)

Handling difficult to master because of surging loads, creating an unstable vehicle

Often carry hazardous materials

EXAMPLES: Petroleum/Chemical Tanker

Ranges from one to five compartments

Available with or without baffles

Capacities up to 9,500 gallons

Acid Tank

- Identified by small diameter tank and external stiffener rings Variety of linings and baffles
- Can be insulated
- Capacity: Up to 6,000 gallons of liquid

Liquified Gas Tanks

- Designed for high pressure
- Transport butane, propane, oxygen, hydrogen, other gases in liquid state

Insulated Tank

- Made of steel
    - Can carry materials up to 500°F (260°C)
- Made of aluminum
    - Can carry materials up to 400°F (204°C)

Milk Tankers

- Unbaffled with smooth linings
- Must be kept especially clean
- Rarely used for other cargo
- Trips often made with partial loads, i.e., loads become smaller as deliveries made
- Especially difficult to master handling because of smooth, unbaffled interior and partial loads
- Handling
    - Problems created from improper:
        - Acceleration--liquid shifts rapidly toward rear
        - Braking--shifts rapidly forward--causes vehicle to jump ahead again when almost stopped
        - Turning--center of gravity moves outward
    - Handling problems magnified with partial load, with or without baffles
    - Driver should:
        - Accelerate gradually
        - Anticipate stops (apply brakes gradually)
        - Avoid braking in turns
        - Turn tanker at safe speed under control (the greater the speed, the greater the force of momentum). Avoid breaking during turns

Special Requirements (liquid tankers)

- Driver training--requires increased levels of knowledge and proficiency in handling
- Specific training would depend upon type of trailer and cargo
- Road use and permits--see individual State requirements and (hazardous materials transportation regulations)
- Inspection
    - Check tanker for leaks
    - Check all hoses, valves and fittings
    - Thereafter, use standard semi-trailer inspection procedures
    - Emergency valve release

Visual 8 Example of Trailer Transporting Livestock

Livestock Transport

Description

- Semi-trailer with flat floor or
- Double drop frame design
- Slots or holes insides to allow livestock to breathe
- May have side doors instead of at rear or may have both

Uses

- Transportation of live animals, i.e., cattle, sheep, hogs, etc.

Characteristics

- Length maybe anywhere from 27-45 feet (27 feet in doubles)
- Fixed tandem axle.
- Can be converted to operate with two or three decks, for smaller animals, e.g. pigs, sheep
- Some can be converted into dry freight vans for backhaul

Handling

- Live cargo can create problems (shifting of animals)
- Driver should:
    - Drive at speed where he can safely keep vehicle under control
    - When braking, tap brakes lightly to set animals, then gradually apply brakes
    - Never attempt to drive without proper training

Special Requirements

- Driver training--requires increased levels of knowledge and proficiency in handling
- Driver responsible for "passengers" health and safety enroute
- Road use and permits--see State requirements for transportation of livestock

Visual 9 Refrigerated Vehicle

Refrigerated Trailers (Also Called "Reefers")

Two types of refrigerated trailers

- Nose mount--refrigeration unit mounted on upper front of trailer
- Belly mount--refrigeration unit mounted under trailer

Description

- Semi-trailer, van "box" type
- Some have racks or rails suspended from roof (also called "meat railers" on which beef, pork or lamb carcasses are hung)
- Others have separate compartments (some cargo frozen, some kept cool)
- Contain slotted floors to allow for air or gas circulation)

Uses

- Refrigeration of some cargo and some chemicals, e.g., meat, vegetables, fruit

Other Characteristics

- Refrigeration units have own engines powered by:
  - Gasoline
  - Diesel
  - Liquified petroleum gas
- Also have own fuel tank
- Floors, sides, and roof thickly insulated

Handling

- High center of gravity on meat-railer models
- Swinging meat (beef, lamb, pork carcasses) is more of a handling problem than sloshing liquid
- Loosely packed swinging meat loads create very dangerous stability problems
- Safeloading procedures are vital

Special Requirements

- Driver training--requires increased levels of knowledge and proficiency in handling
- Road use and permits--see individual State requirements (transportation of edible cargo)
- Inspection
  - Check trailer:
    - Holes in walls
    - Ceiling and floor ducts
    - Doors and door gaskets
    - Fuel level of reefer
    - Reefer engine
      - Coolant
      - Oil
      - Refrigerant level

Special Cargo Vehicles

Includes any vehicle designed to haul primarily one particular type cargo

EXAMPLES: Tankers Designed to Transport Edible Cargo
Should not transport any non edible cargo (e.g., milk tanker)
Should follow State guidelines for transporting certain types of edible cargo in the same tank

Visual 10 Pole Trailer

Pole Trailer

- Designed to carry long narrow cargo
- Telescoping
- Hauls:
  - Poles
  - Timbers
  - Logs
  - Steel girders
  - Concrete beams
- Consists of 2 "U" shaped cradles (bunks), connected by a steel pole (reach)

Reach can be shortened or lengthened
Some designed without a reach (load "poles" become body)
Some use straight truck as tractor with front bunk mounted on a flat bed body

Visual 11 Auto Transport Trailer

Auto Transport Trailer

Designed to transport only cars and pickup trucks
Can carry six full size cars, up to ten subcompacts
Various sizes and arrangements designed mainly by car carrier for specialized field

EXAMPLE: Six-car rack most common example
Ramp can be raised/lowered
Cars drive on/off ramps
Variation: Seventh car mounted on rack above tractor

Special Handling Vehicles

Vehicles that present special handling problems because of visibility, location of steering axle, etc.
City Pickup and Delivery Tractors

Visual 12 Low Cab Forward

Cab in front of engine.
Small diesel used for city pickup and delivery work
Heavy duty diesel used as combo city and short distance line haul rig

Visual 13 Snub Nose Tractor

Short BBC Conventional (also known as a "snub nose")

Conventional cab tractor
Rear of engine protrudes into cab
Often used for close clearance city work

Visual 14 Heavy Duty Half Cabs

Cab-Beside-Engine (also known as a "half cab")

Heavy duty diesel
Most frequently used as a "yard horse" or "goat" (shuttle transfer)

Visual 15 Dromedary Tractor

Dromedary Tractors

Tractors with a cargo body mounted between the rear of cab and fifth wheel
"Drom box" may be loaded from rear or side doors

EXAMPLES: 8 x 4 heavy duty dromedary tractor
6 x 2 or 6 x 4 dromedaries that pull car racks

Recap

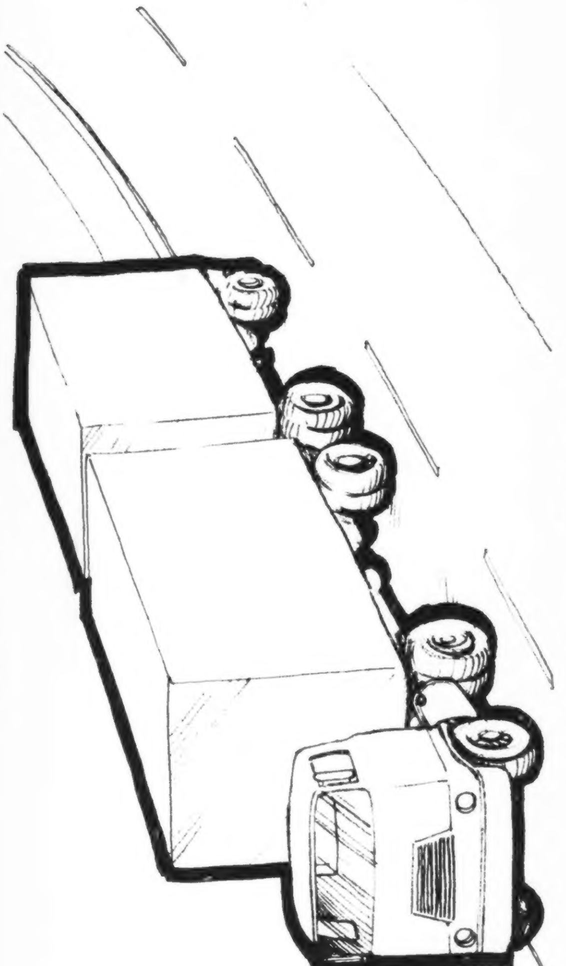
Many special rigs hazardous in hands of untrained
Special training is needed
Special rigs often require special permits, license

Review

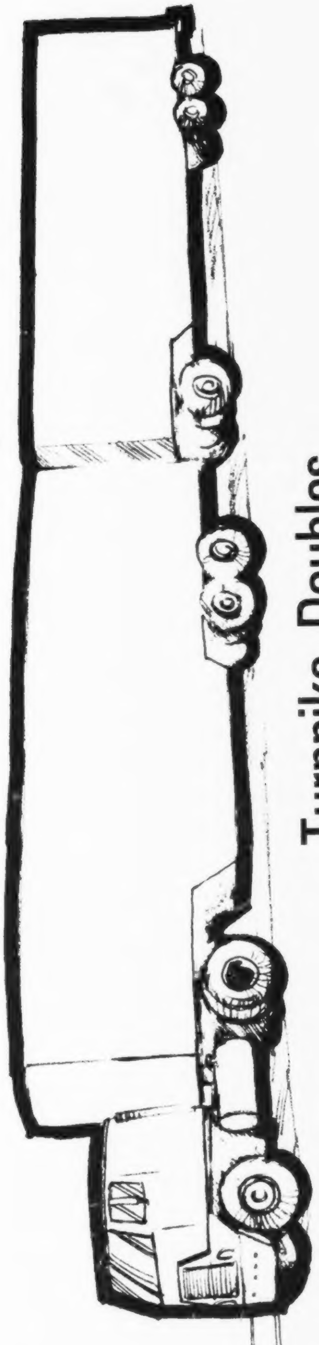
Allow time for question and answer period

Visual 1

Twin Trailers

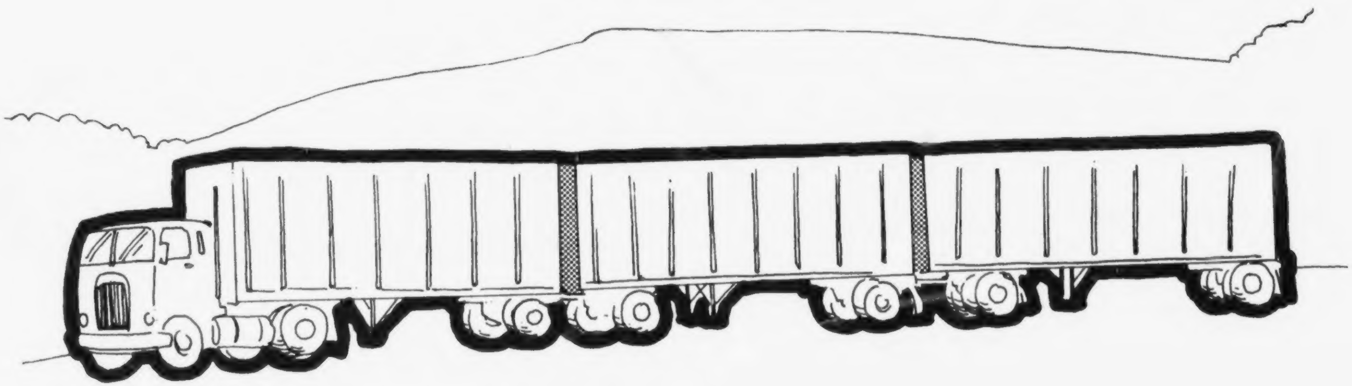


Western Doubles

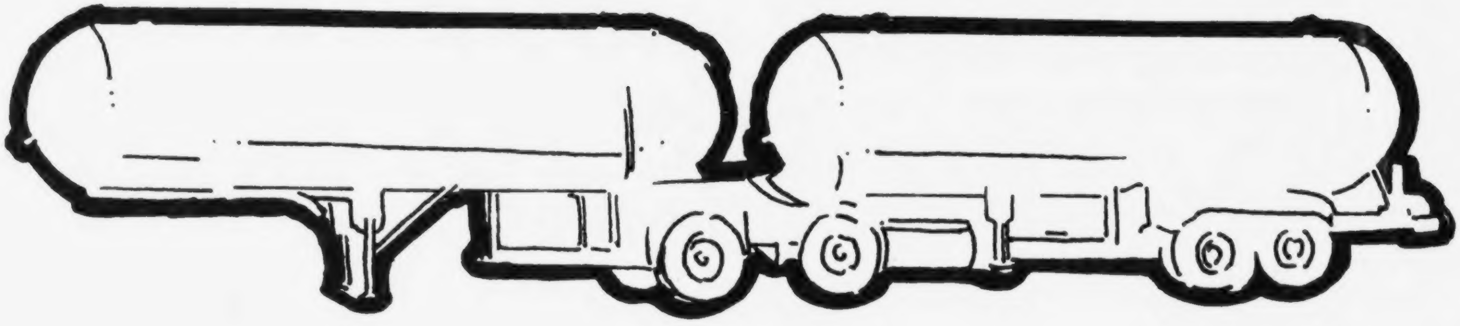


Turnpike Doubles

Triple Trailers

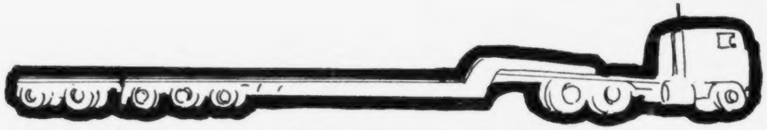


B-Trains

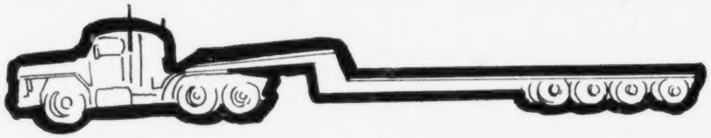


Special Trailer Types

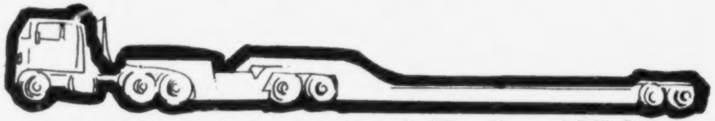
(Oversized Loads)



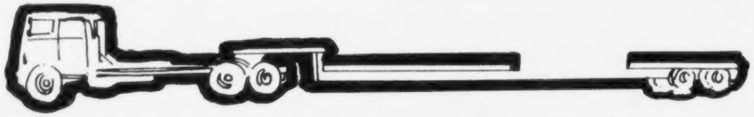
5-Axle Removable Gooseneck Low Bed With Detachable 2-Axle Dolly



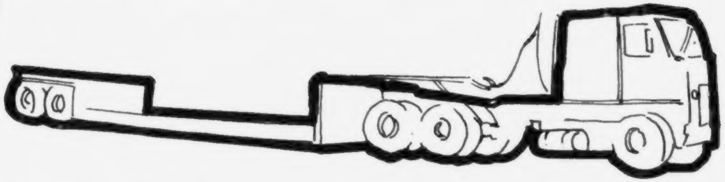
4-Axle Removable Gooseneck Low Bed With Outriggers



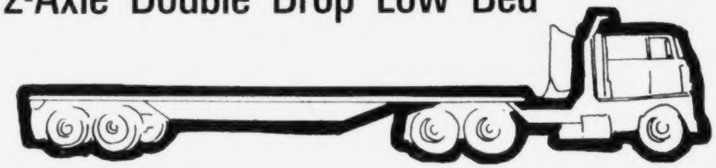
Multi-Wheel Low Bed Trailer With Jeep Dolly



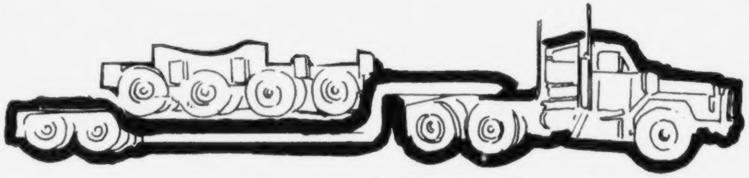
2-Axle Extendable Low Bed Trailer



2-Axle Double Drop Low Bed



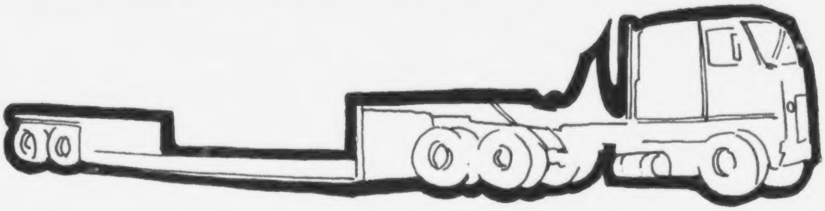
2-Axle Float



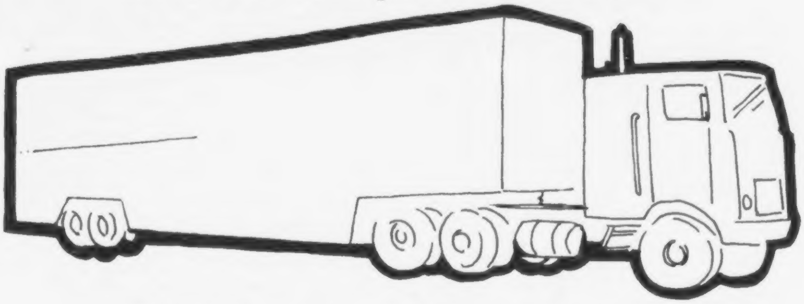
Custom Trailer and Dolly for Hauling Large-Diameter and Long Commodities

Visual 5

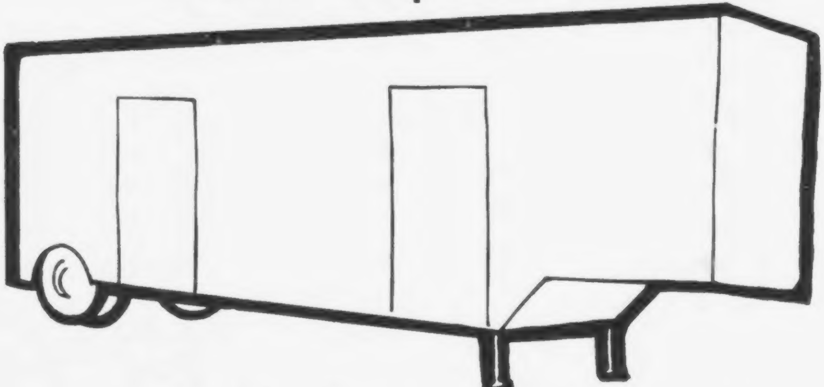
Low Clearance Vehicles



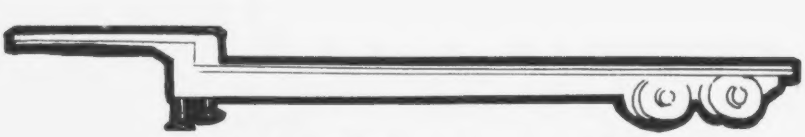
Double Drop Low Bed



Double Drop Furniture Van



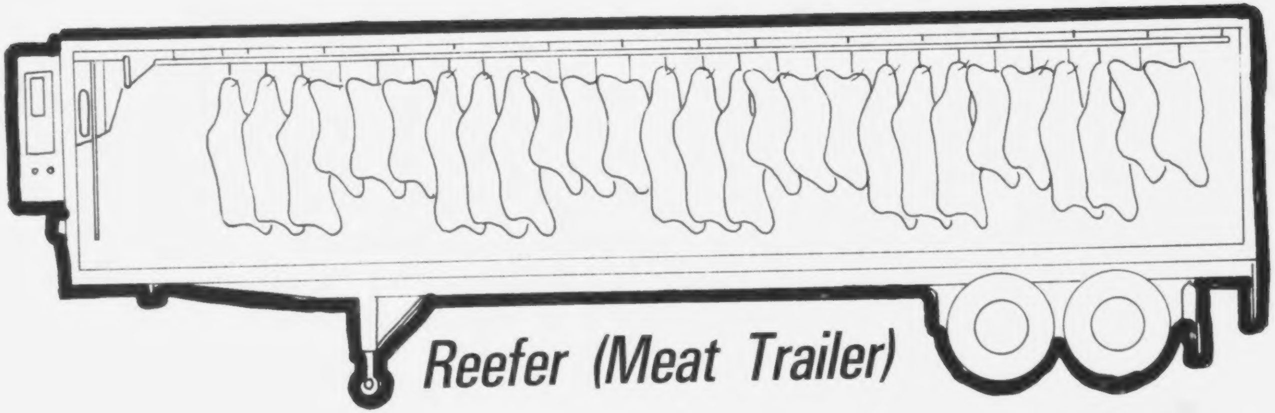
Single Drop Warehouse Van



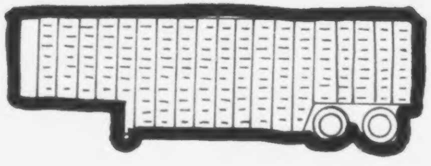
Single Drop Low Bed

Visual 6

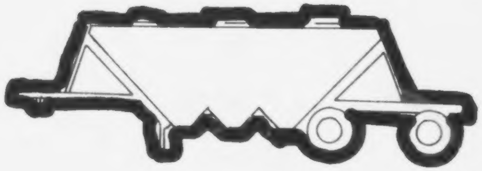
High Center of Gravity Vehicles



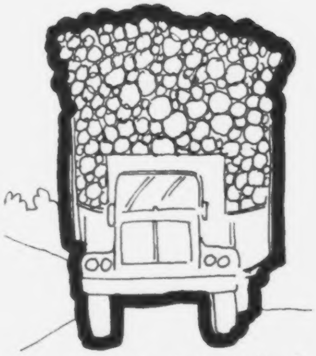
Reefer (Meat Trailer)



Livestock
Transport



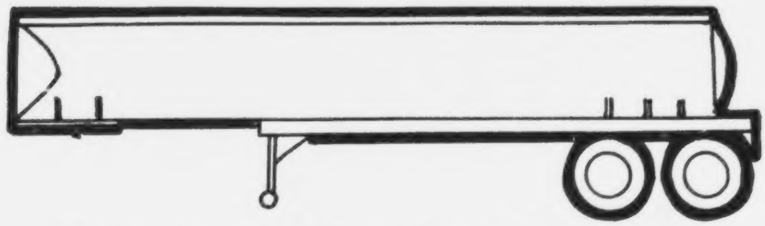
Dry Bulk Tankers



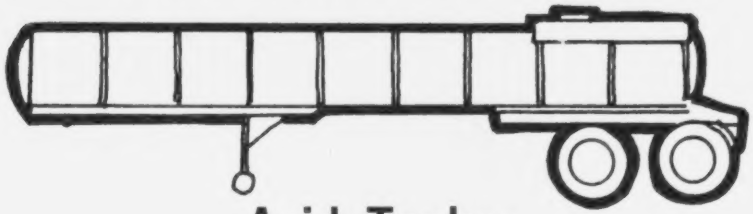
Oversized Vehicle
With Oversized Load

Visual 7

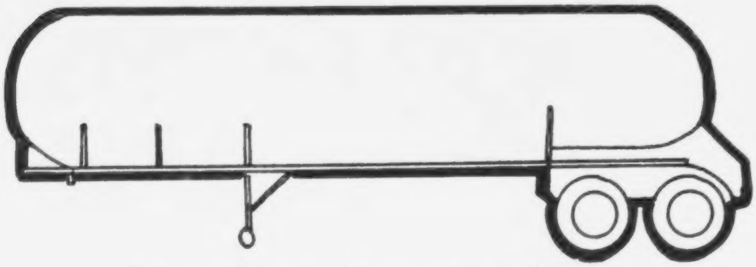
Examples of Tankers



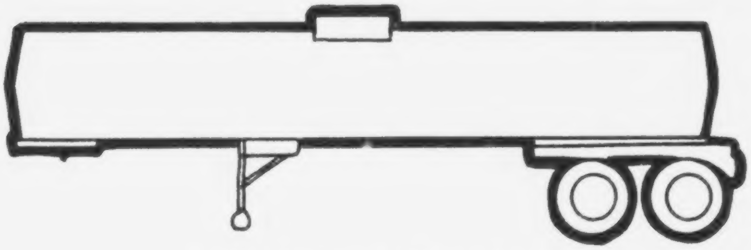
Petroleum/Chemical Tanker



Acid Tanker



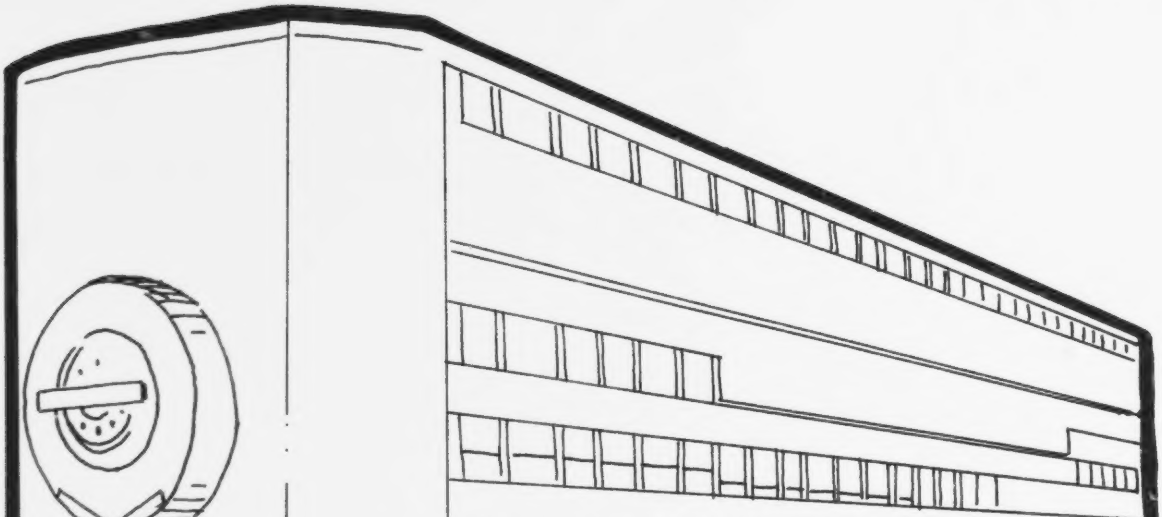
Liquified Gas Tanker



Insulated Tanker

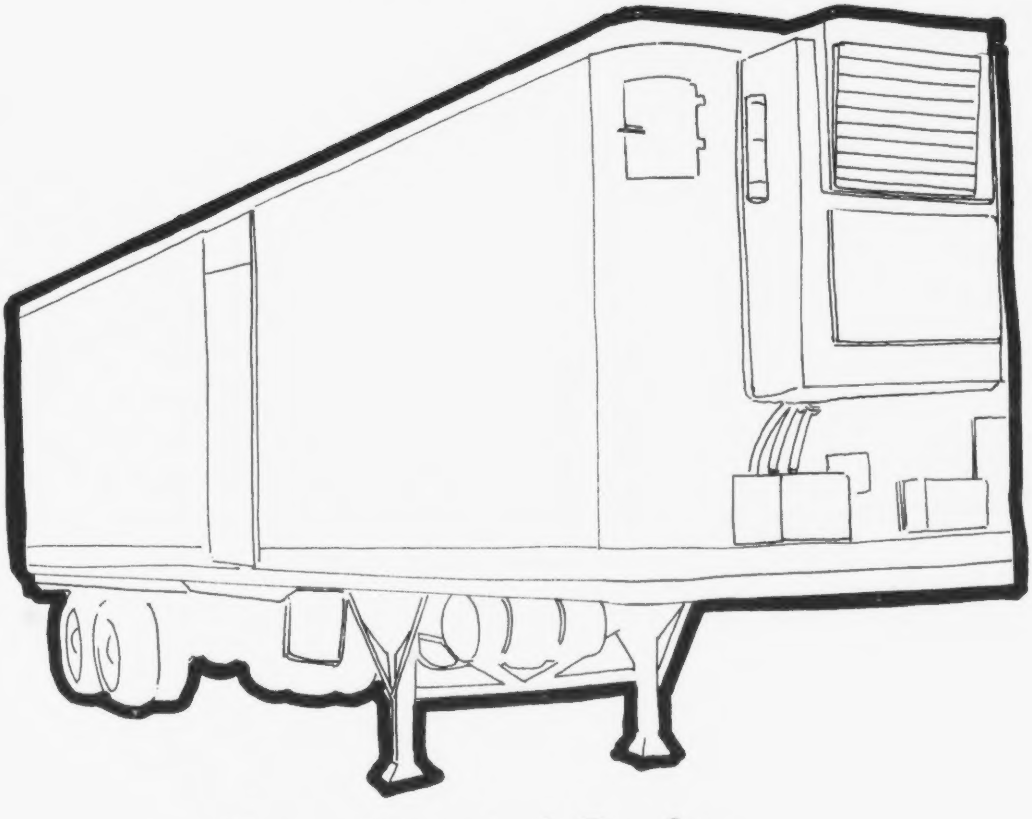
Visual 8

Livestock Transport Trailer



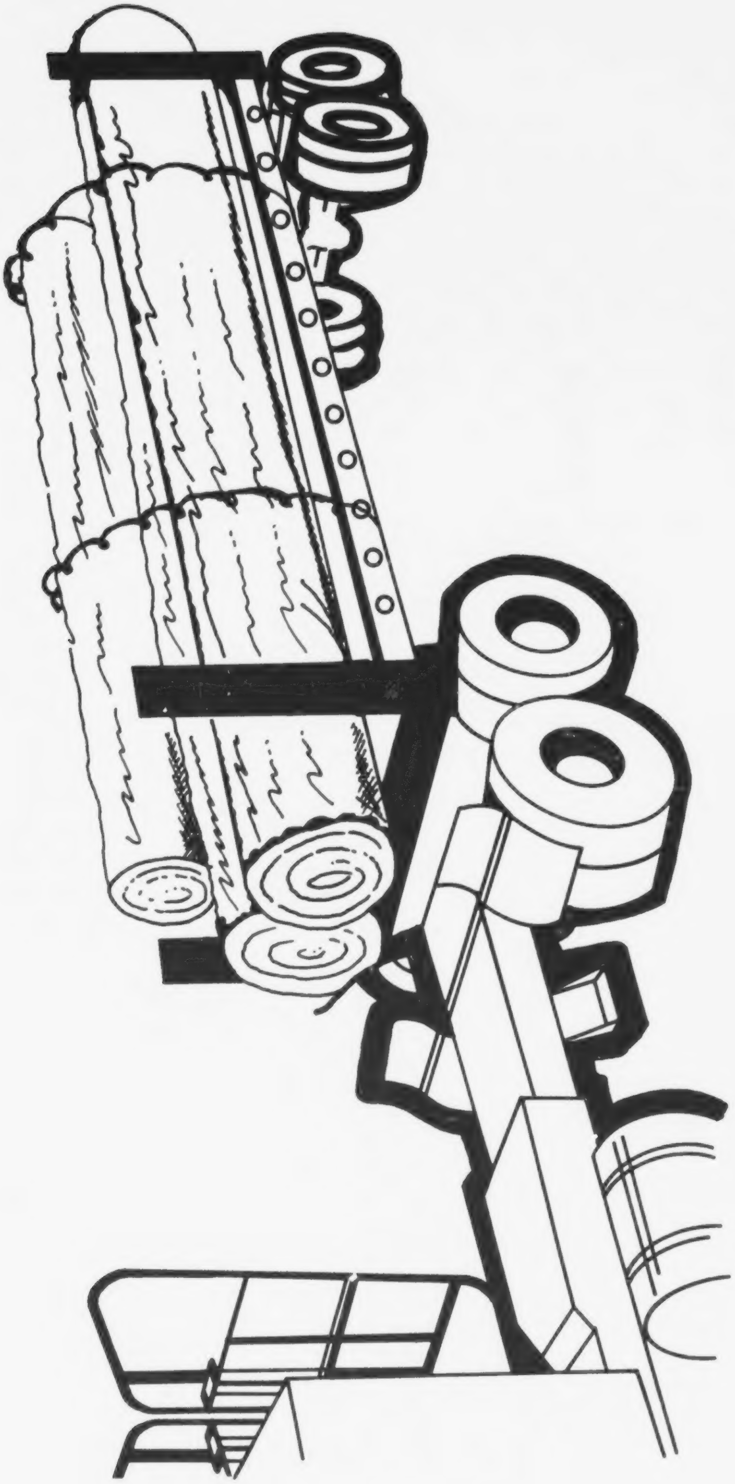
Visual 9

Refrigerated Semi-Trailer

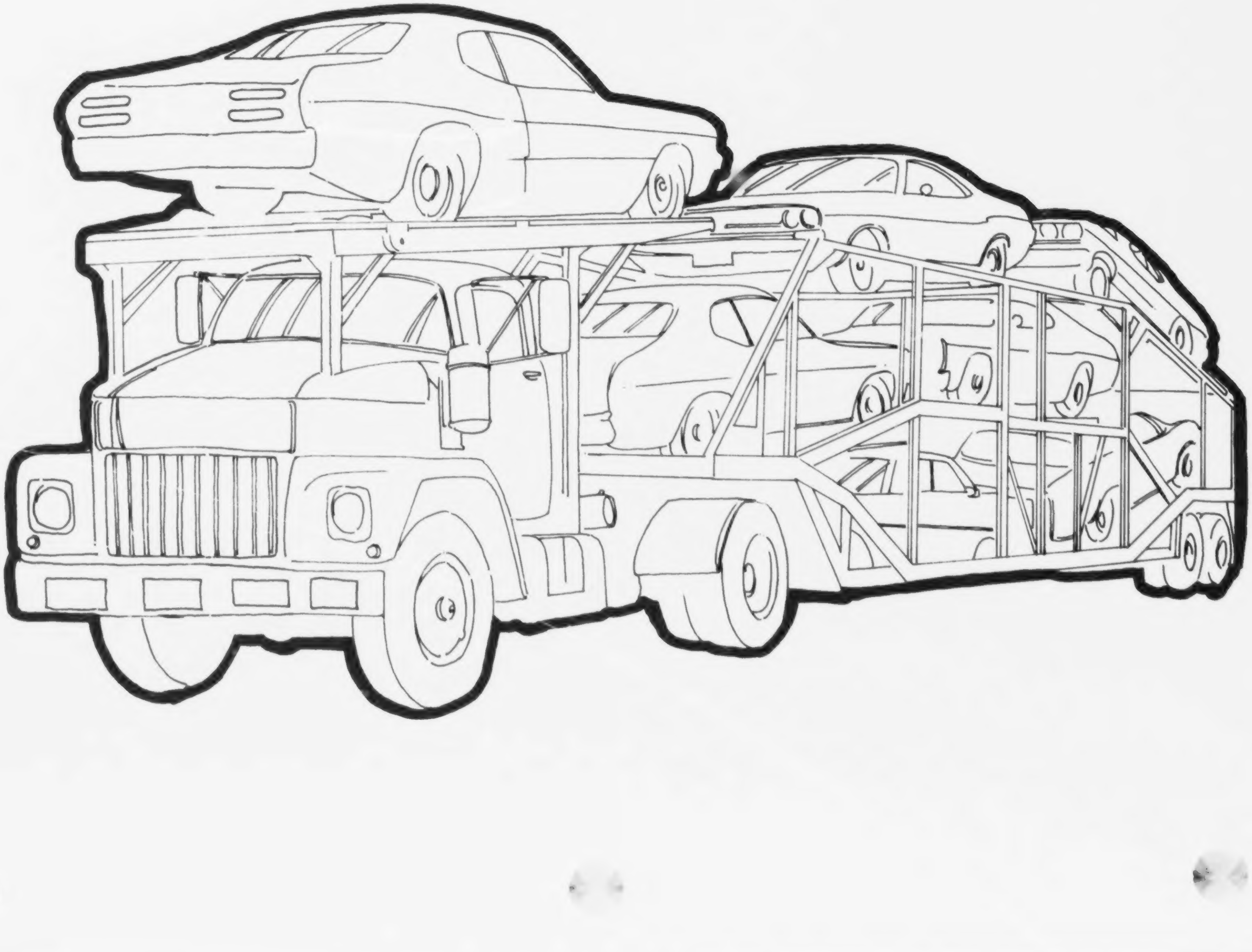


Nose Mounted Reefer

Pole Trailer

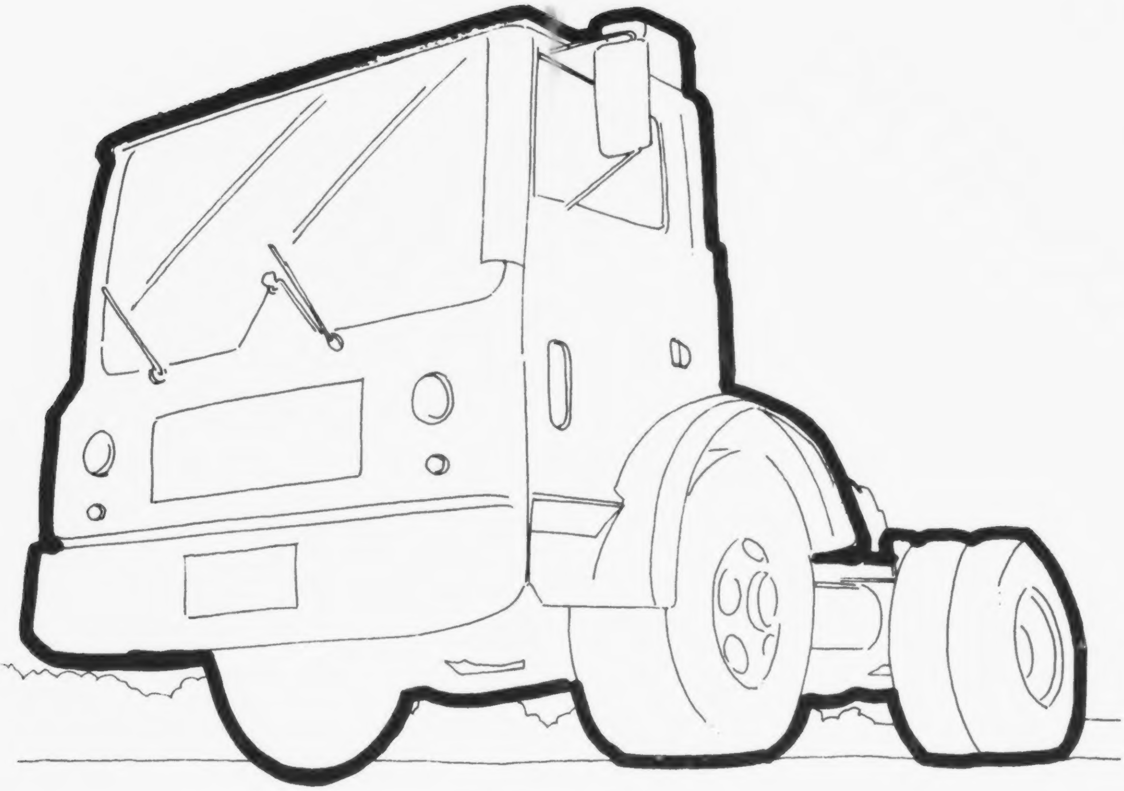


Auto Transport



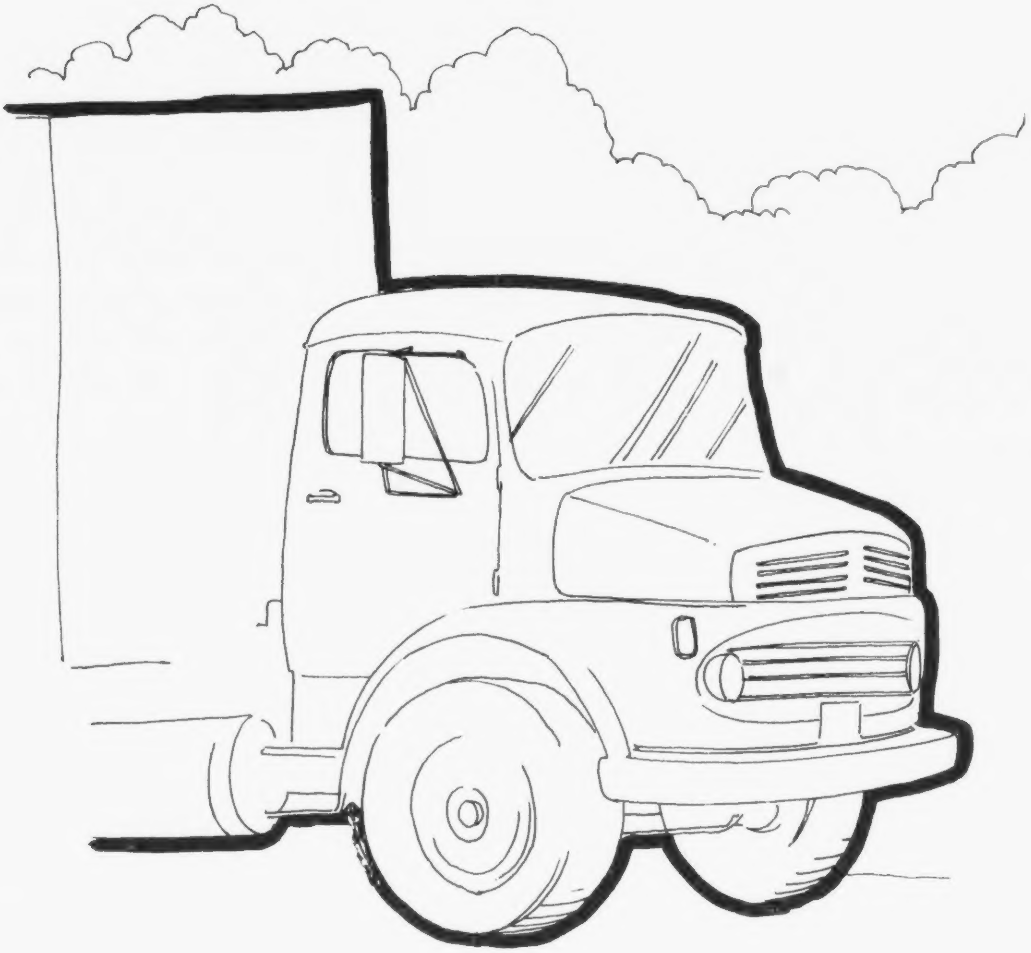
Visual 12

Low Cab Forward Diesel Tractor

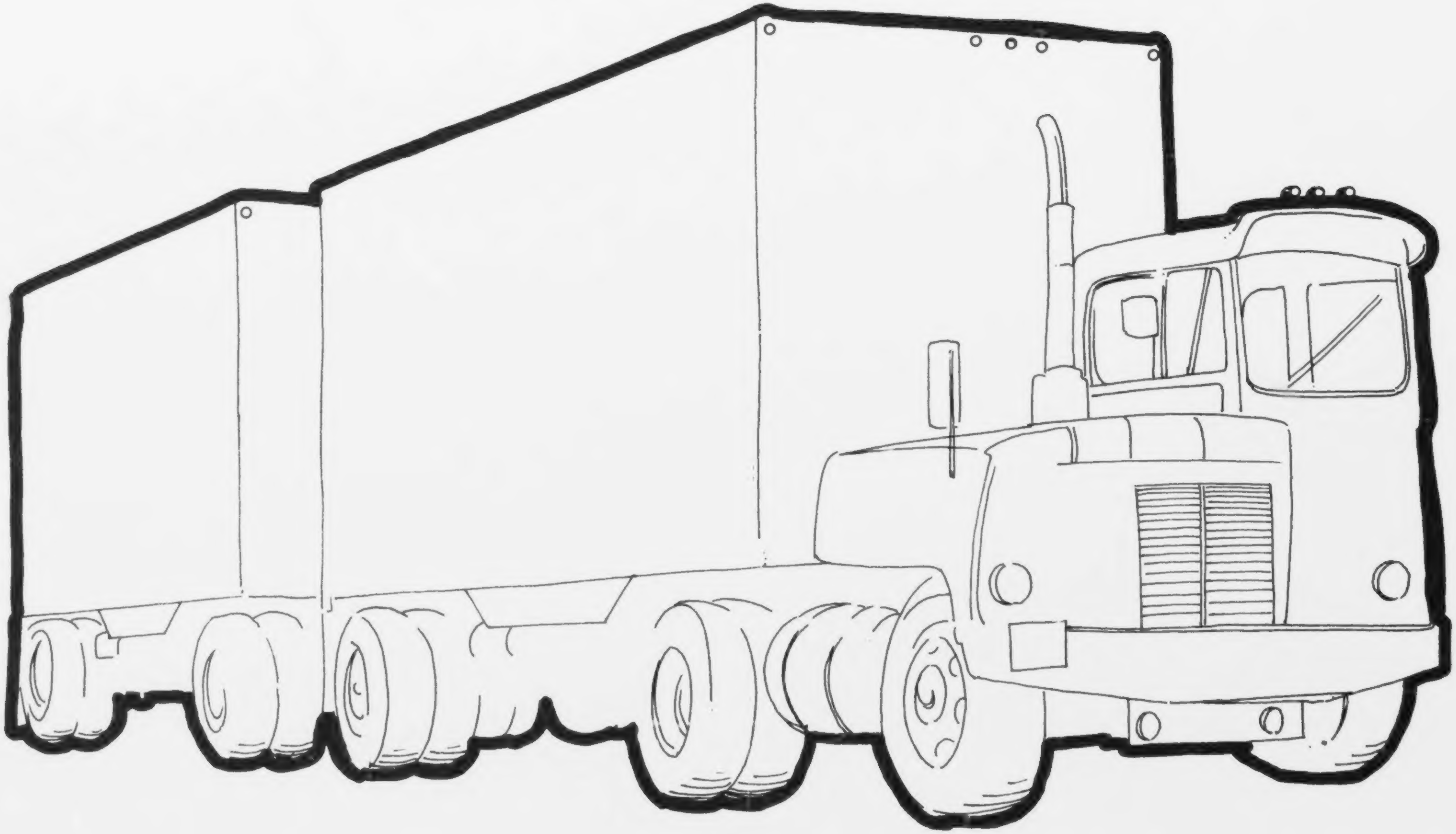


Visual 13

Snub Nose Diesel Tractor

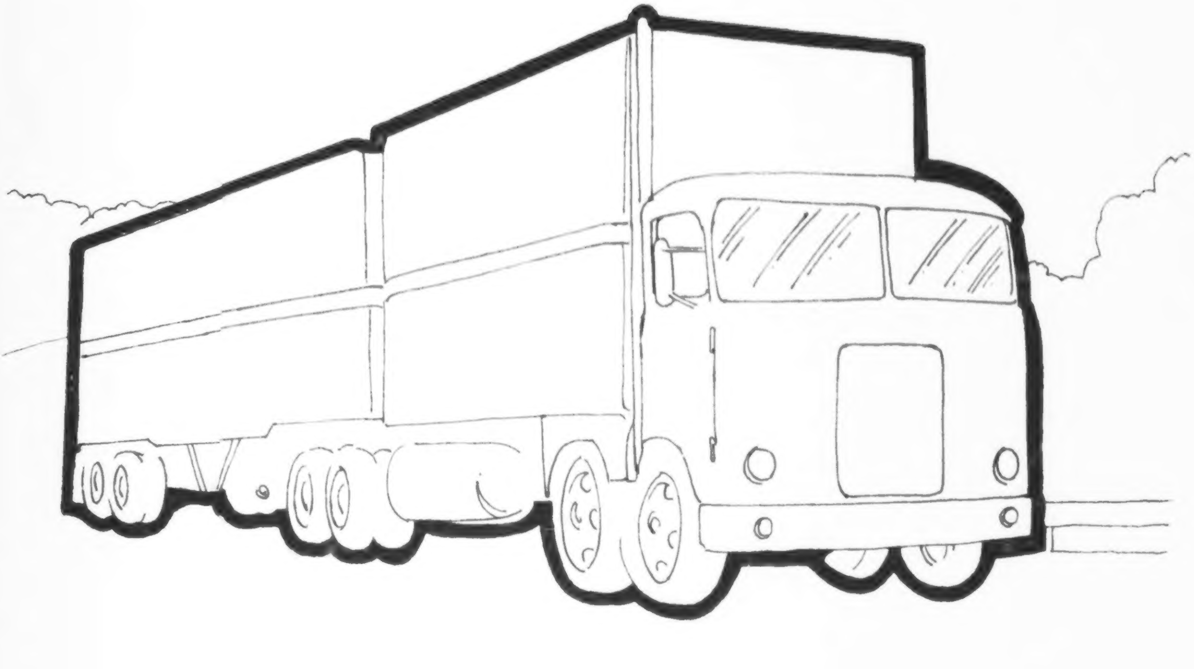


Cab Beside Engine Tractor
Heavy Duty "Half Cab"



Visual 15

Dromedary, C.O.E. Heavy Duty Diesel Tractor–Twin Screw With Tandem Steering Axles



LESSON 2 OBSERVATION OF SPECIAL RIGS (LAB)

Overview

Time Alloted: 3 hours 30 minutes

Prerequisites: Unit 1.9, Lesson 1

Purpose:

The purpose of this lesson is to expose students to special rigs through (1) a field trip in which students will visit local transportation or vehicle manufacturing firms to see various types of special rigs, and (2) having the instructor point out special rigs as they are encountered during onstreet lessons. Due to the time required and the minimal contribution to safety, this lesson should be treated as optional. This lesson can be combined with Lesson 4 in Unit 5.1 to achieve maximum efficiency.

Materials

Instructional Aids

None

Student Material

None

Instructional Material

No additional material required

Equipment

Any type of special rigs to which access can be obtained

Transportation for students to such facilities as trucking companies, truck dealers or manufacturers

Content

Activity or Topic	Approximate Time
1. FIELD TRIP TO LOCAL FIRMS	3 hours 30 minutes*
2. IDENTIFICATION OF SPECIAL RIGS DURING ONSTREET ACTIVITIES	**

---

* Plus travel time

** As time and safety permit during onstreet activities

1. FIELD TRIPS TO LOCAL FIRMS (3 hours 30 minutes)

Purpose

The purpose of this exercise is to arrange and carry out a field trip visit so that students can observe special rigs.

Directions

Preparation

Investigate yellow pages for potential field trip sources that manufacture, service, or use vehicles identified in Lesson 1 of Unit 1.9
Local trailer manufacturers
Local tractor manufacturers
Local transportation firms that service or use special rigs

Contact Sources

Explain purpose of visit
Arrange for time and length of visit
Ask about availability of company representative to conduct visit
Ask about number of students who can be accommodated in field trip, both in terms of facilities available and ease in which students can observe special rigs

Arrange for Visit

Divide students into large groups depending on type of visit and available facilities
Instructor accompanies each group on field trip

Field Trip

Conducted based on requirements and facilities of local firm(s)
If it can be arranged, allow time for students to observe demonstration of equipment and time for question and answer period

There is no observation or evaluation for this exercise.

2. IDENTIFICATION OF SPECIAL RIGS DURING ONSTREET ACTIVITIES

Purpose

The purpose of this exercise is for students to identify special rigs encountered during onstreet training lessons.

Layout

This exercise should occur in conjunction with onstreet activities particularly those longer over the road exercises in which student-observers can safely participate.

Directions

As special tractors or trailers are encountered, the instructor should ask students to identify vehicle, state its function and, if possible, observe handling characteristics.

Identification and discussion of special vehicles encountered should not detract from major purpose of street lesson nor violate any safe driving requirements, e.g., distract from driver's attention.

Evaluation

Students will be evaluated on their ability to identify special vehicles.

Notes:

SAFE OPERATING PRACTICES

SECTION 2
SAFE OPERATING PRACTICES

This section teaches the practices required for safe operation of the tractor-trailer on the highway. Once students have learned basic control of the vehicle, they must learn how to control the vehicle in a way that will assure their own safety as well as that of others.

Instruction in safe operating practices is presented in the following units:

Unit 2.1 - Visual Search--To enable the driver to search the road for hazards and critical objects.

Unit 2.2 - Communication--To enable students to communicate with other motorists effectively in response to various conditions.

Unit 2.3 - Speed Management--To enable students to manage vehicle speed effectively in response to various conditions.

Unit 2.4 - Space Management--To enable students to manage the space required for safe vehicle operation.

Unit 2.5 - Night Operation--To enable students to operate safely at night.

Unit 2.6 - Extreme Driving Conditions--To enable students to operate their vehicle safely under extreme conditions, including adverse weather, hot weather, and mountain driving.

Unit 2.7 - Proficiency Development: Safe Operating Practices--To provide students an opportunity to refine and polish vehicle handling skills and safe operating practices.

Organizing instruction in terms of general practices, such as Visual Search and Communication, differs from that of many curriculums, which are organized in terms of specific tasks, such as right turns, passing, merging. The reason for organizing instruction in terms of practices is that most students who enter training for tractor-trailer driving already know how to perform basic tasks from their experience in driving automobiles. The problem is that they very frequently do not carry out these tasks in a safe manner.

Basic Practices

What primarily determines whether a task is carried out safely or not is how well the driver searches, communicates, manages space, and manages speed. These basic processes underlie almost all tasks. For example, signaling a change in position on the highway is done essentially the same way whether one is pulling into traffic, turning a corner, merging on a highway, leaving a highway, passing another vehicle, or simply changing lanes. Signaling can be dealt with more efficiently if it is covered in depth in one lesson instead of spreadying it out over several lessons.

Tests of students entering tractor-trailer driver instruction courses show that they are rather well informed concerning most tasks and safe operating procedures. However, they are frequently derelict in putting into practice what they know. The same is often true when they graduate from school. For example, a group of tractor-trailer operators who signaled 85 percent of their turns and lane changes on a license test given after graduation, signaled only 33 percent when they were observed while driving alone.

In order to motivate students to make greater use of safe operating practices, this section focuses more heavily upon the why than it does upon the how. This was another reason for organizing instruction into general practices. Generally speaking, the reasons why a particular practice is needed are the same regardless of the task in which it is performed. For example, the reasons for signaling a position change are the same -- to give drivers of hidden vehicles a chance to react -- no matter what task is being performed.

Special Conditions

The first four units, Units 2.1 through 2.4, introduce the four basic safe operating practices that are required in normal, day-to-day driving. The next two units, Units 2.5 and 2.6, deal with the application of safe operating practices under two special conditions: night driving and extreme weather and temperature conditions. These conditions complicate the use of safe operating practices and are therefore introduced after the basic practices have been dealt with.

Street Lessons

Each of the units dealing with safe operating practices involves a street lesson. As mentioned in the General Instructions (see Introduction), each of these street lessons focuses upon the specific practices taught in the unit. This approach differs from that employed by many schools in which instructors are free to deal with any aspect of street operation.

The purpose for having dedicated street lessons is to make sure that there is a close association between classroom and street instruction, and that practices taught in the classroom are followed up as quickly as possible with behind-the-wheel instruction in the same area.

UNIT 2.1
VISUAL SEARCH

UNIT 2.1 VISUAL SEARCH

PURPOSE

The purpose of this unit is to enable the driver to search the road for hazards and critical objects.

OBJECTIVES

Performance Objectives

Students must

- maintain a minimum 12-second eye lead time.
- scan both sides of the road using quick glances to observe roadside activity and the behavior of adjacent vehicles.
- maintain a visual pattern that involves frequent checking of all mirrors for hazards, particularly before changing speed or direction.
- frequently check individual instruments.
- look ahead as far as possible during turns and on curves.
- monitor overtaking traffic to be aware of vehicles in the rear and side blind spots.
- avoid diverting attention from path ahead longer than a second at a time.

Knowledge Objectives

Students must know

- the proper adjustments of the various types of mirrors.
- the differences in images presented by flat and convex mirrors.
- the importance of making all visual checks to the sides and rear of the vehicle and visual checks of the mirrors quickly in order to limit the amount of time a driver's eyes are off the road ahead.
- the relationship between speed and sight distance.
- search patterns appropriate for straight driving, changing speed or direction, and entering or crossing traffic.

Skill Objectives

Students must be able to

- read and interpret the images presented by flat and convex mirrors.
- maintain a straight-line path while diverting attention from the road ahead.

Attitude Objectives

Students must believe that

- the ability to respond to changing road conditions requires proper visual scanning.
- that mirrors will not reveal every hazard.
- development of good visual search habits is essential to safe driving and will reduce driver fatigue.

LESSONS

Lesson 1.	**Visual Search Principles (Classroom)**	**1 hour 15 minutes**
Lesson 2.	**Use of Mirrors (Lab)**	**45 minutes**
Lesson 3.	**Application of Visual Search (Street)**	**8 hours**

LESSON 1 VISUAL SEARCH PRINCIPLES (CLASSROOM)

Overview

Time Allotted: 1 hour 15 minutes

Prerequisites: Unit 1.7

Purpose:

The purpose of this lesson is to explain the principles of visual search. In the first half of this lesson the basic principles of visual search, visual lead time, scanning to the sides, handling intersections, are discussed. The second part of the lesson concentrates on the use of mirrors and techniques for seeing to the rear. Problem-solving exercises reinforce key ideas. The lesson ends with a brief discussion of commentary driving to prepare students for visual search activities on the road.

Materials

Instructional Aids

Visuals 1-15

Student Material

Rules for Commentary Driving: Visual Search, in Unit 2.1 of Student Manual

Instructor Material

Instructors must know how to adjust and "read" the mirrors on the vehicles used in school.

Content

Activity or Topic	Approximate Time
1. SEEING AHEAD AND TO THE SIDES	30 minutes
2. USE OF MIRRORS	20 minutes
3. SEEING TO THE REAR	15 minutes
4. COMMENTARY DRIVING	10 minutes
	1 hour 15 minutes

1. SEEING AHEAD AND TO THE SIDES (30 minutes)

Importance of Seeing in Driving

Almost all driving is response to what driver sees

Seeing Properly: Most important part of safe driving

Seeing Improperly: Number one cause of accidents

- View is limited or blocked
- Looking at wrong place at wrong time
- Driving with a "fixed stare"
- Windshield and mirrors not clean and clear

View From Tractor-trailer

- Better view ahead above cars, i.e., seeing over the traffic
- Problems seeing to sides and rear
  - Right side and alongside drive wheels on both sides
  - Seeing small vehicles
- Scanning should encompass five vehicle positions
  - Vehicle immediately ahead
  - Vehicle farther ahead
  - Vehicle on left
  - Vehicle on right
  - Vehicle behind

Visual 1 Seeing Ahead 10-15 Seconds

Distance Scanning

Looking Way Ahead Helps to Drive Smoothly, Efficiently and Safely

Always steer or "aim" at an imaginary target in the center of your line of travel as far ahead as possible (at least 10 to 12 seconds - more if you can do so). This is called "eye lead time" - it also aids in keeping vehicle centered in your lane of travel.

- Looking far enough ahead gives time to
  - Spot a problem
  - Decide what is the smoothest way to avoid it (e.g., change lanes, stop, adjust speed)
  - Check for traffic that might keep driver from making move
  - Make move
- Allows move by vehicle ahead to be anticiapted (e.g., "sudden" stop)

Scanning Pattern

- Look to sides as well as center of road.
- Distance scanning allows wider scene to be viewed.

10-12 Seconds Lead Time Needed for 4 Step Adjustment Process

- 10-12 seconds ahead depends on situation
  - Amount of traffic
  - Available sight distance
  - Good general rule called "12 second eye lead time":

- City
  - 12 seconds equals one block
  - Driver needs to look ahead one city block

- Highway
  - Travel greater distance in 12 seconds
  - 12 seconds equals about one-fourth of a mile distance

- Driver needs to look ahead about one-fourth of a mile in highway travel or at least try to
- When he can't, it will automatically warn of need to be extra alert and/or slow down

Looking All Around is Important

- Should not look off into the distance at all times
- Need to check
  - Status of road users behind vehicle
  - Instruments
  - Signs
- Keep eyes moving both near and far
- (From directly in front of vehicle to at least a 10-12 second distance)
- Ultimate goal is to develop an eye lead time of at least 15 to 20 seconds

Summary

- Benefits from adequate visual lead time and looking ahead correctly
  - Increases safety by identifying hazard early
    - Big rigs need more time to react to situations
    - Cuts down on accidents and conflicts
    - Driver has time to identify and safely react to hazards

  - Saves fuel by spotting traffic situations early
    - Avoids abrupt stops and radical speed adjustments that waste fuel
    - Lets driver adjust smoothly to traffic, this in turn keeps vehicle speed constant, which produces fuel efficiency

  - Saves time by spotting traffic situation early
    - Driver avoids being trapped behind lef turning vehicle, being in wrong lane or missing highway exit

Visual 2 Checking to the Sides and Rear

Scanning to the Slides

Should periodically scan sides when driving
Must look to sides in critical situations

When it is Critical to Scan to the Sides

- Crosswalks--for pedestrians, bicycles, mopeds, etc.
  - Pay particular attention to right as pedestrians, etc., are closest
  - Yield right of way to pedestrians when turning on green

- Intersections--learn to look in the correct sequence
  - Look to left first
    - Traffic coming from that direction will hit you first
  - Look to right next
    - There is a lane to cross before running into traffic
  - Look to left again
    - To catch the guy who wasn't there before

- Watch out for blind spot at "2 o'clock" position created by right side westcoast mirror and/or cab corner posts

Other Busy Places Where it is Critical to Scan to the Sides

- School zones--for small children darting into traffic
- Construction sites--for construction vehicles and workers
- Shopping centers--for shoppers pulling into flow of traffic
- Hospital zones and fire statons--for emergency vehicles

How to See When Stopped at an Intersection

- Seeing to the sides is critical when stopped at intersections
- General rules for handling intersections include the following:
  - Nose vehicle out very slowly
    - Give vehicles on cross street a chance to see you
    - Give yourself a chance to stop again before pulling into path of cross traffic
    - Use the left-right-left looking pattern

EXAMPLE: An intersection in which view is blocked by obstacle

Procedure: Stop twice
- First at the stop sign
- Ease forward to where you can see oncoming traffic

Visual 3 Problem-Solving Exercise: Recognizing Obstacles

Prolem-Solving Exercises

Problem-Solving Exercise #1

Ask students to identify and discuss potential traffic obstacles in their path as shown in the illustration.

Students should identify the following:
- Car may pull around truck on left
- Pedestrians crossing street ahead
- Car may back into traffic from right
- Bicyclist on the right side

Briefly discuss the effects of failing to look ahead properly. Ask students to cite their own experiences with near misses, being caught in the wrong lane, etc., and how the failure to conduct a proper visual search adversely affected their driving.

Visual 4 Problem-Solving Exercise: Making a Left Turn

Problem-Solving Exercise #2

Describe the situation and then ask students to discuss it briefly. Use the questions below to aid in the discussion.

Situation

You are stopped to turn left across a major highway. At the same time, another truck is ready to turn right onto the street where you are stopped. He waves you to come on. What are the dangers in this situation?

The dangers of this situation are:

The other truck blocks your view of lane 2

The other truck blocks the view of drivers in lane 2 so they can't see you

You can't be sure that the trucker who has signaled you to come on has checked out all the traffic in lane 2. His concern is making his right turn.

What are the options you have and what are the dangers?

Answers

Backing

Back up and let the other truck make his turn. Backing a tractor-trailer is always dangerous. Unacceptable

Turning

Make a right turn. Lane 1 is protected by the other vehicle and you can backtrack. This would take you out of your way and still necessitates a left turn. Impractical

Ease Out

Ease out with nose even with the vehicle. This lets you see oncoming traffic in lane 2 and lets them see you. There is a real danger of getting hung up before you can complete your turn. However, generally, this is the preferred alternative.

Summary to Problem Solving Situation

Some principles to keep in mind when view is blocked by other traffic.

First and safest

Let whatever is blocking your view get out of the way.

Second

Change your route. It is better to go a little out of your way to avoid a crash.

Third

Move little by little until:
- Your view is improved
- Others can see you
- Your vehicle is not in the path of cross traffic

2. USE OF MIRRORS (20 minutes)

Importance of Mirrors When Driving

Rearview obtained by cab mounted outside left and right mirrors

Critical to check mirrors before changing speed or position in traffic (e.g., lane changes or passing) especially to check blind spot (alongside tractor's fuel tank and drive wheels)

Two Types of Side Mirrors

Plane
Convex

Visual 5 Field of Vision Using a Plane Mirror

Plane Mirrors (Flat Mirror)

- Field of vision limited
  - Gives best view of rear of trailer and roadway behind
  - Does not give a wide view
  - Leaves blind area alongside most of length of vehicle
  - Field of view greatest in left mirror
    - The closer the mirror, the larger the image
    - The larger the image, the greater the field of view
- Blind spots on both sides
  - Make lane changing risky
    - Tight turns also a problem
      - Cannot detect adjacent small vehicles
        - Right hand lane change and turn especially difficult
      - Pedestrians, bicyclist, other small vehicles not seen to the side
    - Driver must signal and wait a moment before changing direction

- Perceiving speed and distance of overtaking vehicles with plane mirrors
  - Images similar to those in side view mirror of car
  - Experienced car driver should easily learn to judge speed and distance of overtaking vehicles using plane mirror.

Visual 6 Field of Vision Using Convex Mirror

Convex Mirrors

- Designed with curvature to give a wide angle
- Field of vision
  - Wider view than plane mirror
  - Eliminates most of blind area of plane mirror
  - Best for side closeups

Visual 7 Distortion of Convex Mirrors

Distorts
Image of overtaking vehicles
Image of truck in visual

- Appear smaller and farther away
- Driver might pull out thinking there is enough distance
- Distortion varies with degree of curvature of the mirror

Small stick-on mirrors often added to plane mirror

- Most distortion
- Apt to fall off
- Reduces plane mirror viewing area

- Recent improved models used in combination with plane mirrors.
  - Larger and less distortion

Visual 8 Combination of Plane/Convex Mirror

Combination of Plane and Convex Mirrors

Problem

- Convex mirror alone--too much distortion
- Plane mirror alone--blind area too large

Solution

- Combination of convex and plane mirrors to obtain maximum side and rear vision

Problems with combinations

- Overlapping field of view can confuse driver
- Need high quality convex to reduce overlap and distortion
- Proper adjustment and alignment also reduce overlap

Blind spots can still remain with combination of mirrors

NOTE: Return to Visual 6 and point out blind spot)

- Blind spot at rear of tractor remains
- Driver needs to recognize and adjust to blind spots with any combination of mirrors he has
- Frequent checking of mirrors only way to know if vehicle is lurking in blind spots

Visual 9 Field of Vision of Wide Angle Mirror Making Right Turn

Fender Mirrors

Mounted on fender of long-nose conventional tractor
    Require less eye movement
    Less diverting attention from road ahead
Wide angle fender mirrors (convex)
    Especially helpful in tight turns
    Increase field of vision for right turns
View of road similar to convex mirror but with less distortion

Visual 10 List of Steps for Mirror Care

Taking Care of Mirrors

Adjustment

- Each driver needs to learn to adjust right and left mirrors
- To get maximum view of conditions to the sides and rear
- To eliminate as much of blind spots as possible
- Procedure
  - Adjust mirror position from cab
  - Leave cab and tighten
  - Return to cab and recheck
  - Observe mirror from outside
    - Memorize image
    - Allows future adjustment from exterior

NOTE: Practice adjusting mirrors occurs in Lesson 2 of this unit.

Surface

- Mirrors effectiveness reduced by
  - Glare
  - Dirt
  - Weather conditions (snow, ice, fogged up, mud)
  - Looseness/vibration
- Driver must keep mirrors clean
  - Use wet cloth
  - Dry cloth causes dirt to scratch surface
- Type of equipment available
  - Glare resistant mirrors
  - Mirror heaters

Vibration

- Loose mirrors will vibrate
- Excessive vibration obstructs rearview
- Driver needs to assure that mirrors are firmly secured

Recap

Driver Responsibilities Before Getting on the Road

Clean and adjust mirrors

Know the characteristics of the mirrors used
- Field of vision
- Location and extent of blind spots
- How to read speed and distance of overtaking vehicles
- How to account for distortion of convex mirrors
- Amount of distortion and overlapping

Visual 11 Problem-Solving Exercise: Field of Vision

Problem-Solving Exercise #3

Ask students to briefly discuss how the driver's field of view will be affected in the driving maneuver shown. Vehicle is equipped with combination mirrors but not with a special wide angle mirror on right side.

Questions for discussion
- How will the angle of the rig affect field of view on the left? On the right?
- What kind of potential dangers might not be seen in the field of view to the right?

Answers
- Because of angle of rig, driver has no view alongside left and to the rear of the left of the trailer
- Because of angle of rig and lack of special mirror, driver sees mainly front right part of trailer. Small objects alongside right of trailer and those "underneath" view of mirror, such as small children, pedestrians, bicyclists, and even approaching subcompact vehicles might be missed.

3. SEEING TO THE REAR (15 minutes)

Visual 12 What to Look for in Rear of Vehicle

Using Mirrors to Monitor to the Rear

Check load and cargo securement
Check for loose or falling cargo
Check for tire fires
Check for vehicles adjacent, to your rig which might become a hazard
Know what is beside tractor or trailer in case it is necessary to make a sudden emergency move
Spot vehicle or other road user that may have been struck by trailer (e.g, after intersection)

Visual 13 Use of Mirrors When Changing Position in Traffic

Using Mirrors to Check to the Rear When Changing Speed or Position

Need to use mirrors to check behind when changing direction.
When forced to slow down quickly or unexpectedly.

Changing direction means
- moving from one lane to another.
- entering a freeway or highway from an entrance lane.
- entering the road from the curb or shoulder.
- turning a corner.

Slowing down quickly or unexpectedly
- For turn
  - Alley
  - Entrance
  - Side road
- For obstacle
  - Traffic tie up
  - Disabled vehicle

Changing Lanes

- Always use mirrors when moving to left or right
- Check both plane and convex mirrors
- Be aware of blind spots (make a positive glance in mirrors)
- May need to look more than once to compensate for blind spots
- Make sure there is enough time to look
- It takes longer to check to the rear of a tractor-trailer than a car
  - Checking left side/rear properly takes almost a full second
  - Checking right side/rear properly takes almost a second and a half
    - At 55 mph, 1 second equals 80 feet
  - Make sure it is safe to look away from front of vehicle that long
    - Leave plenty of space between the vehicle in front
    - Look for traffic conditions that indicate vehicle(s) in front may stop suddenly while you are looking away
    - Delay lane change if there is not enough space or time in front of you

Turning a Corner

- Check mirrors while turning
  - Clearance from curb signs
  - Road users trying to squeeze inside
- Check after turning
  - Vehicle not dragging or entangled with anything on anything
  - Haven't caused any damage to anyone or anything

Visual 14 Problem-Solving Exercise: Lane Change

Problem-Solving Exercise #4

Discuss the situation shown in Visual 14

The driver of the truck is going 55 mph and needs to change to the right lane for a truck exit ahead.

Why is it important to see cars 1 and 2?

What potential hazards exist in the scene?

How should he drive the scene?

Answer

With car 3 merging onto the highway, the truck driver needs to be aware that car 2 might change lanes and should be slowing in anticipation. If the trucker is forced to move to the left, he needs to be aware of car 1 alongside him.

The driver needs to be extra cautious in changing to the right lane because of the traffic situation surrounding him. (Use of turn signals discussed in Unit 2.2 Communication.)

4. COMMENTARY DRIVING (10 minutes)

Additional Training on Visual Search Concepts

Learning about visual search continues:
- Lesson 2 (Range), mirror use will be demonstrated and practiced
- Lesson 3 (Street), students will be evaluated on their driving skills and through an instructional technique called commentary driving.

Commentary Driving--The Basic Process

Instructor asks drivers to comment on what they see during short driving segments.

Drivers use one or two word phrases to identify things that should affect their vehicle's direction or speed.

Instructor will evaluate visual search habits by what drivers
- verbally identify
- fial to verbally identify

General Rules

Identify Obstacles/Potential Obstacles

Identify obstacles with short phrases (e.g., stop sign, upcoming stop sign or light, vehicle passing ahead)

Identify only the most important (critical) obstacles, it's impossible to point out all obstacles without getting distracted

Don't look at instructor while talking

Identify, don't explain

Correct: Intersection, stop sign

Incorrect: There is an intersection ahead about 400 feet. I need to start to slow down. (The driving action will suffice for the explanation.)

Comment, "clear path" when no obstacle exists (announce this periodically, not continually)

If unable to both carry on the commentary and give adequate attention to driving, stop talking

Visual 15 Examples of Commentary Driving Situations

EXAMPLES: Ask the students to supply the comment in each part of the sequence

Scene 1. Right Lane Ends

Scene 2. Oncoming Vehicles

Scene 3. Clear Path (Traffic light by itself isn't an obstacle)

Scene 4. Child (The child should be reported before the car)

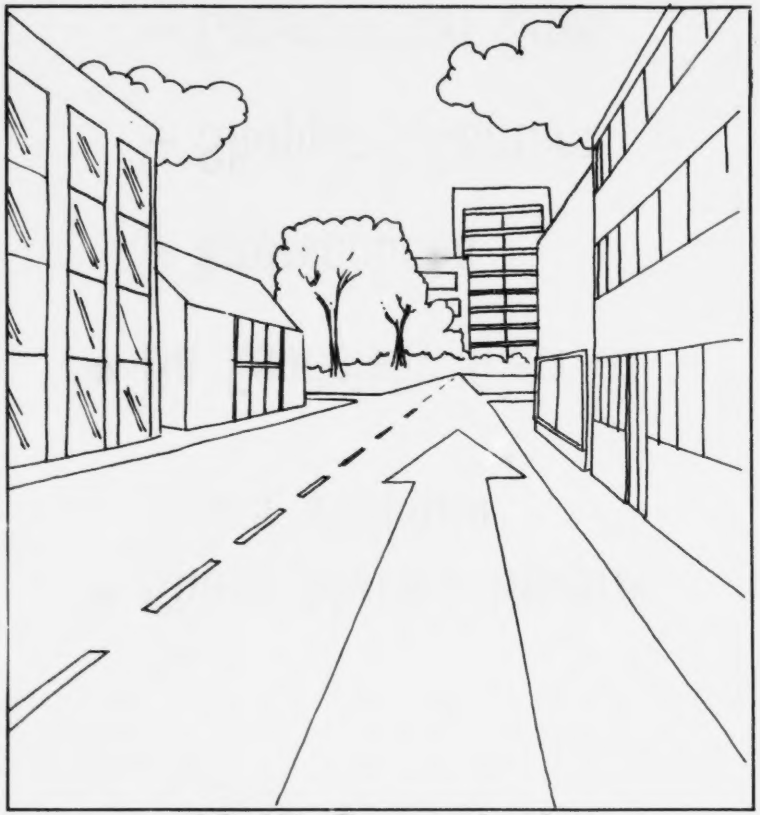
Scene 5. Railroad Crossing

Scene 6. Clear Path

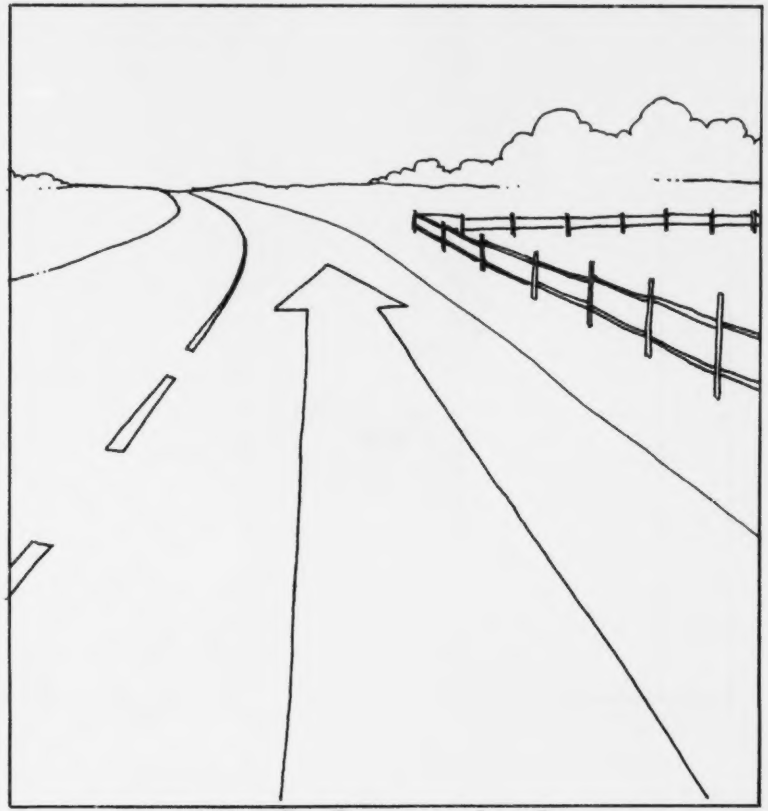
Answer questions and provide additional examples of commentary driving.

Visual 1

Seeing Ahead



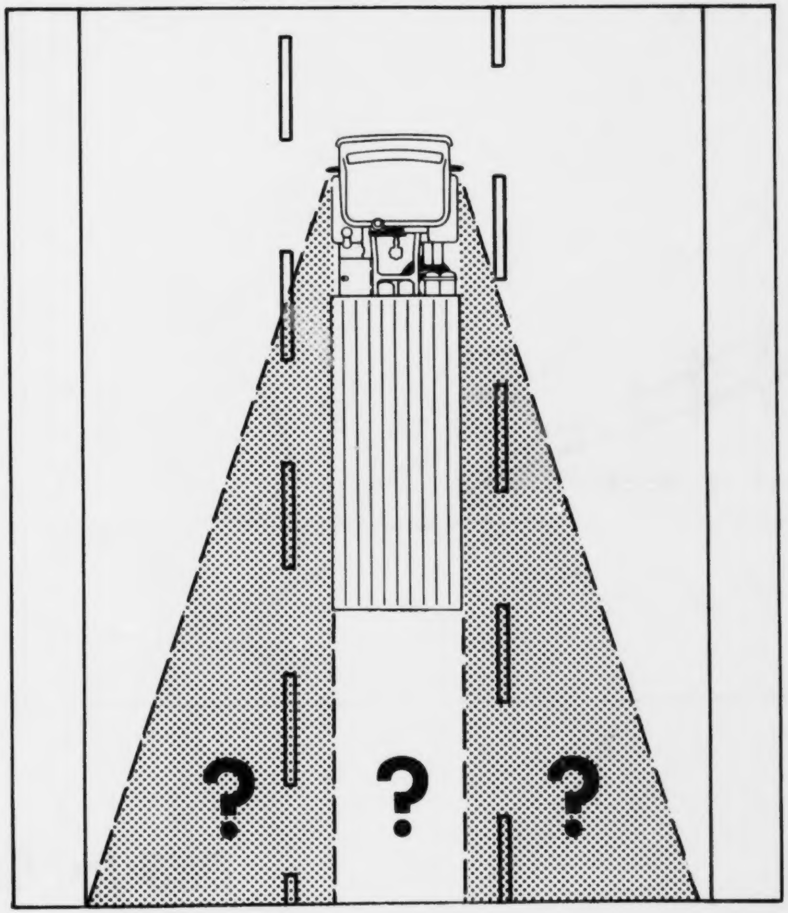
10-15 Seconds Is
About One Block



10-15 Seconds Is
About a Quarter-Mile

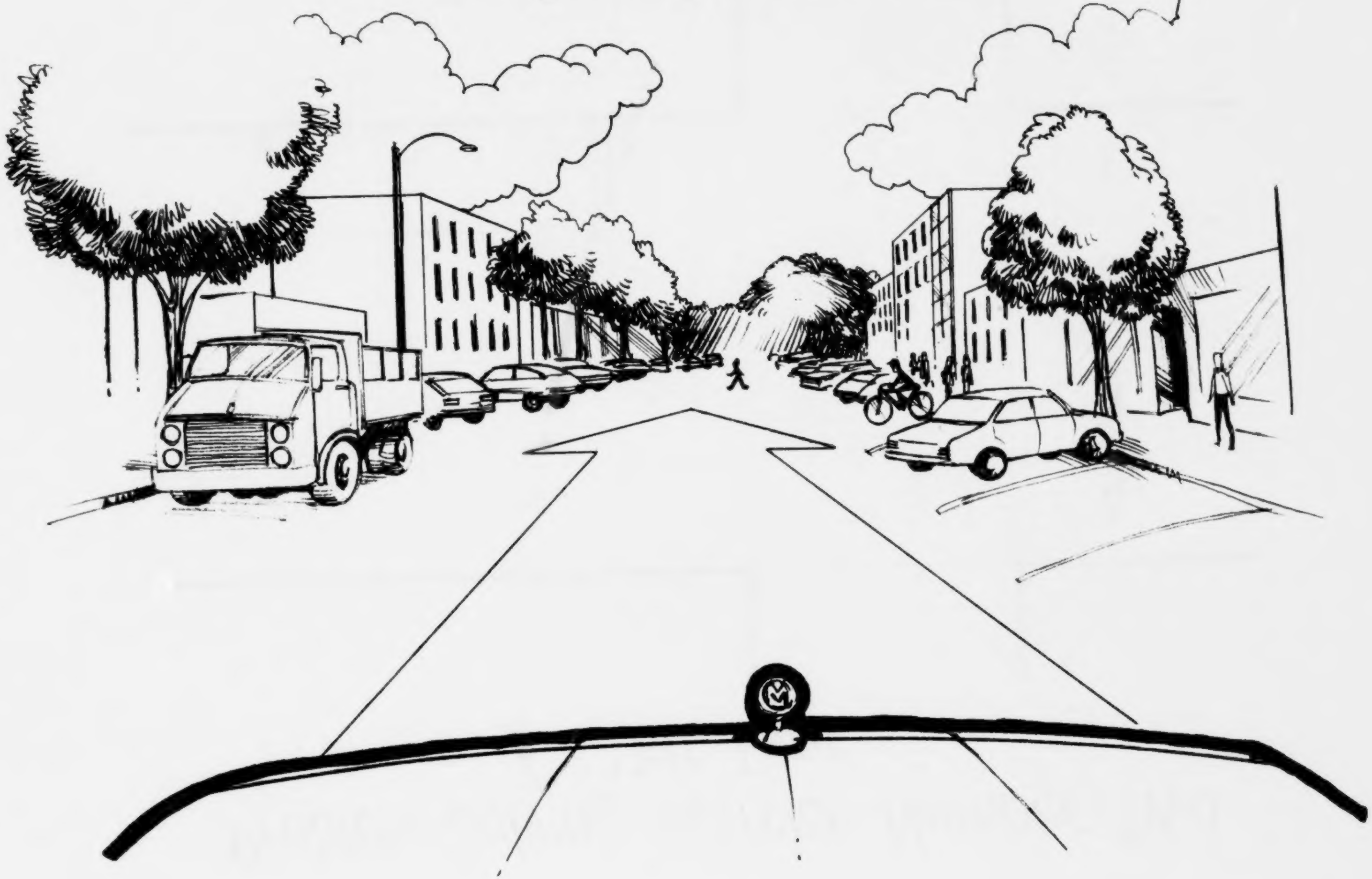
Checking to Sides and Rear

- Check Mirrors Several Times a Minute
- Be Especially Alert at
  - Intersections
  - Shopping Centers
  - Construction Sites
  - School Zones



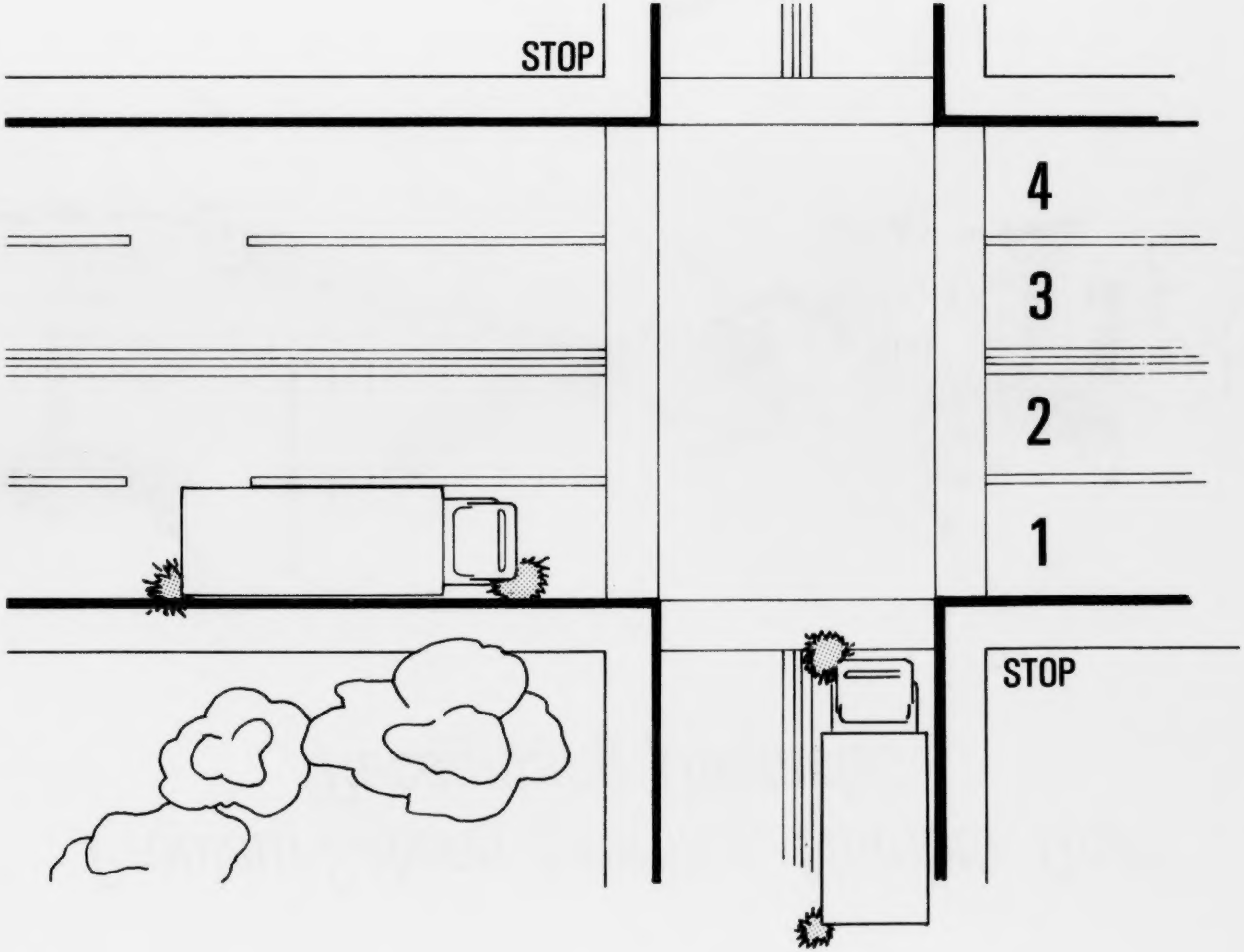
Visual 3

Problem-Solving Exercise: Number One
Recognizing Obstacles



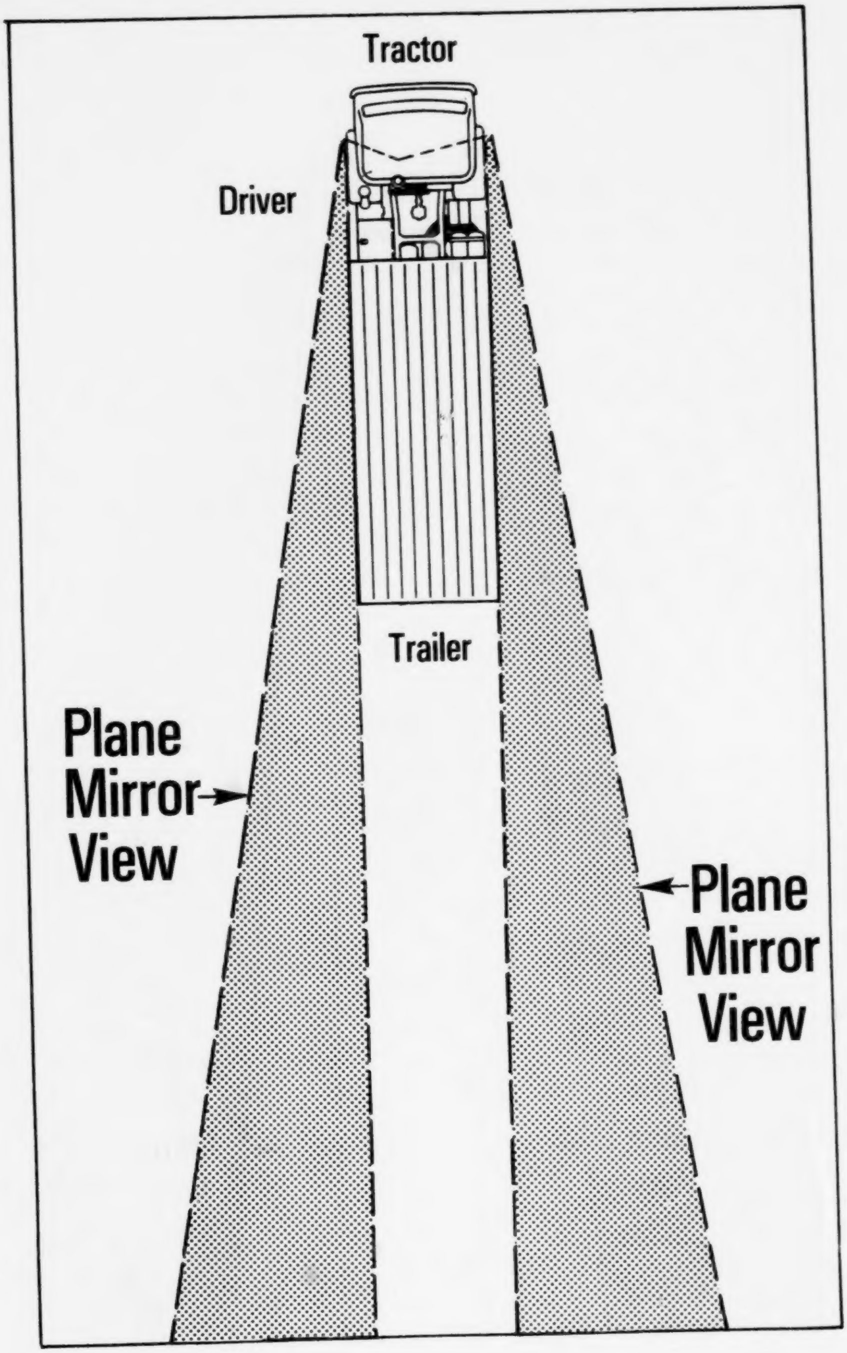
Visual 4

Problem-Solving Exercise Number Two
Left Turn


STOP
4
3
2
1
STOP

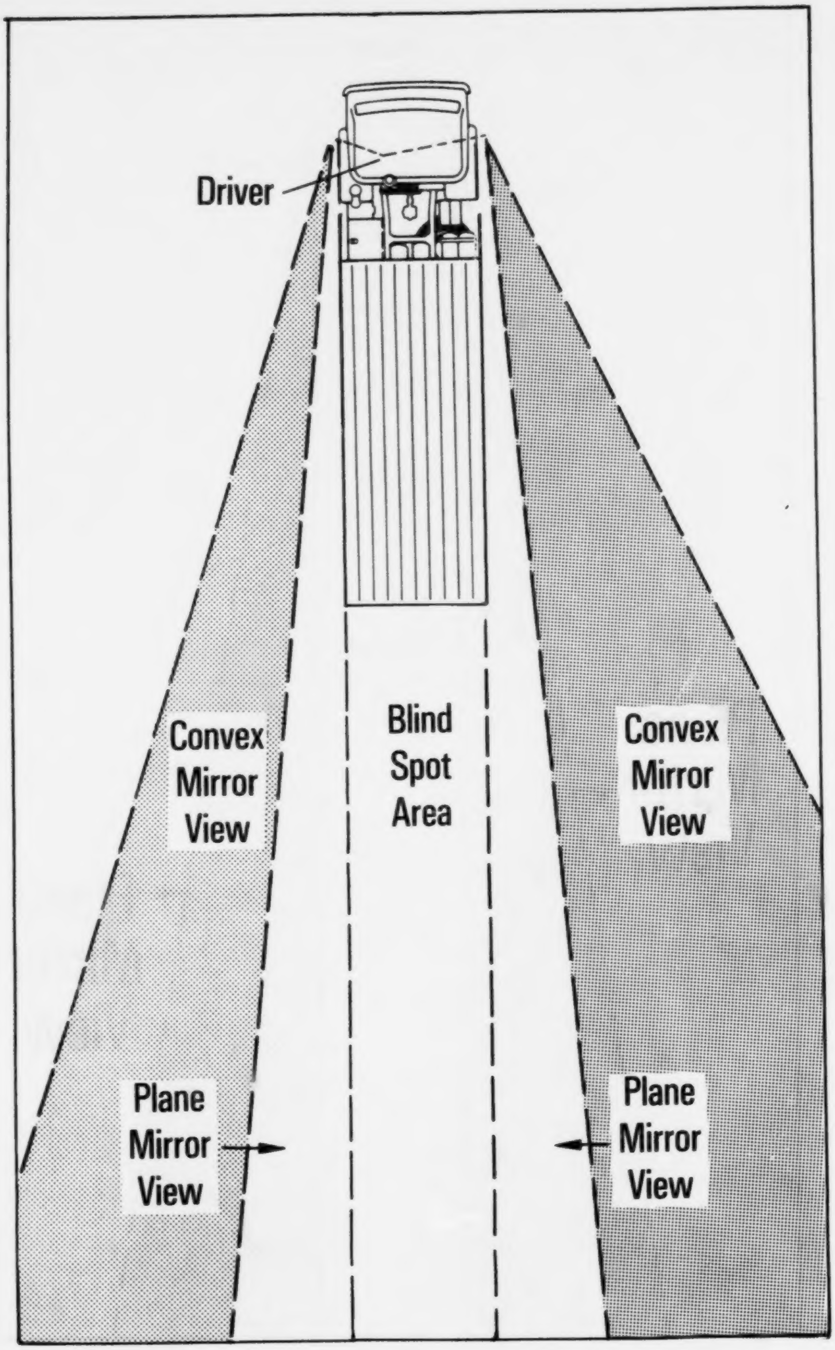
Visual 5

Field of Vision Using a Plane Mirror

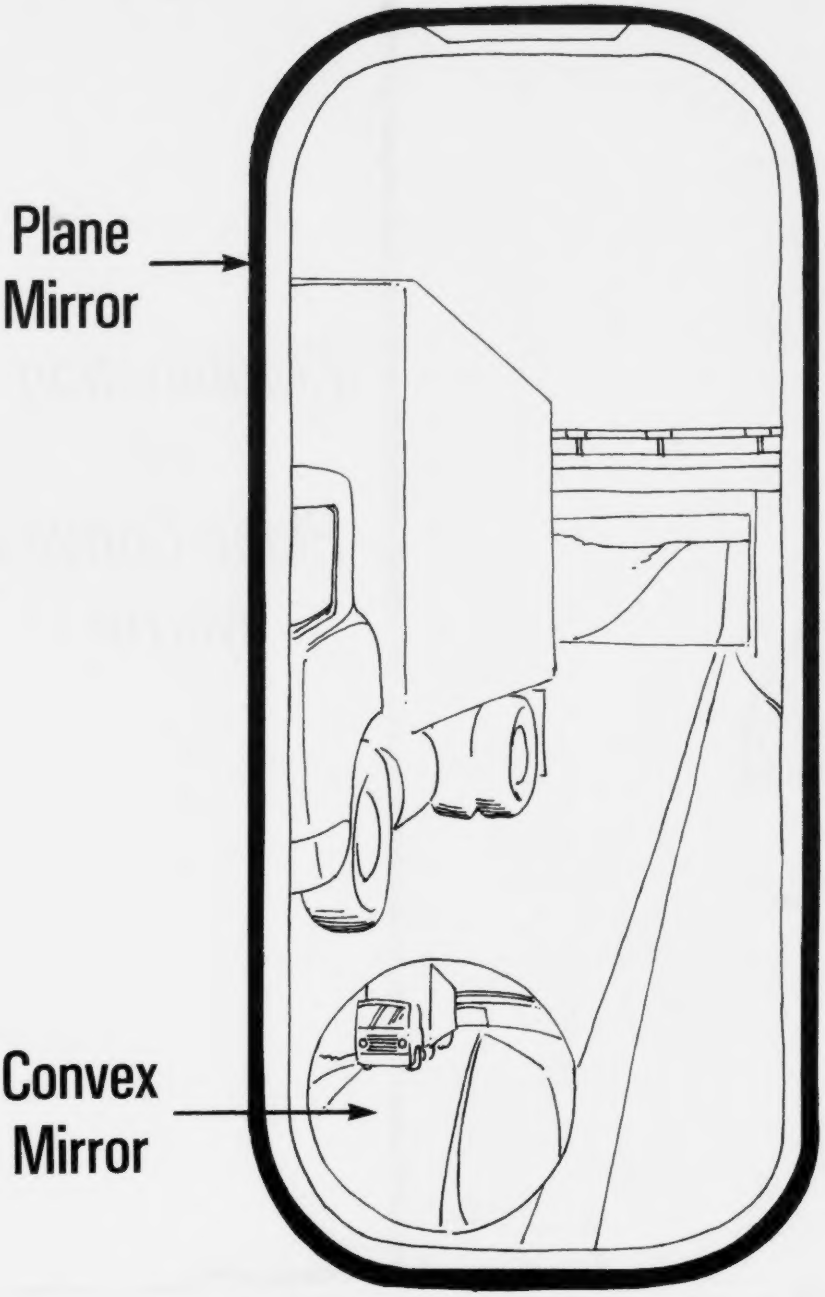

Tractor
Driver
Trailer
Plane Mirror View
Plane Mirror View

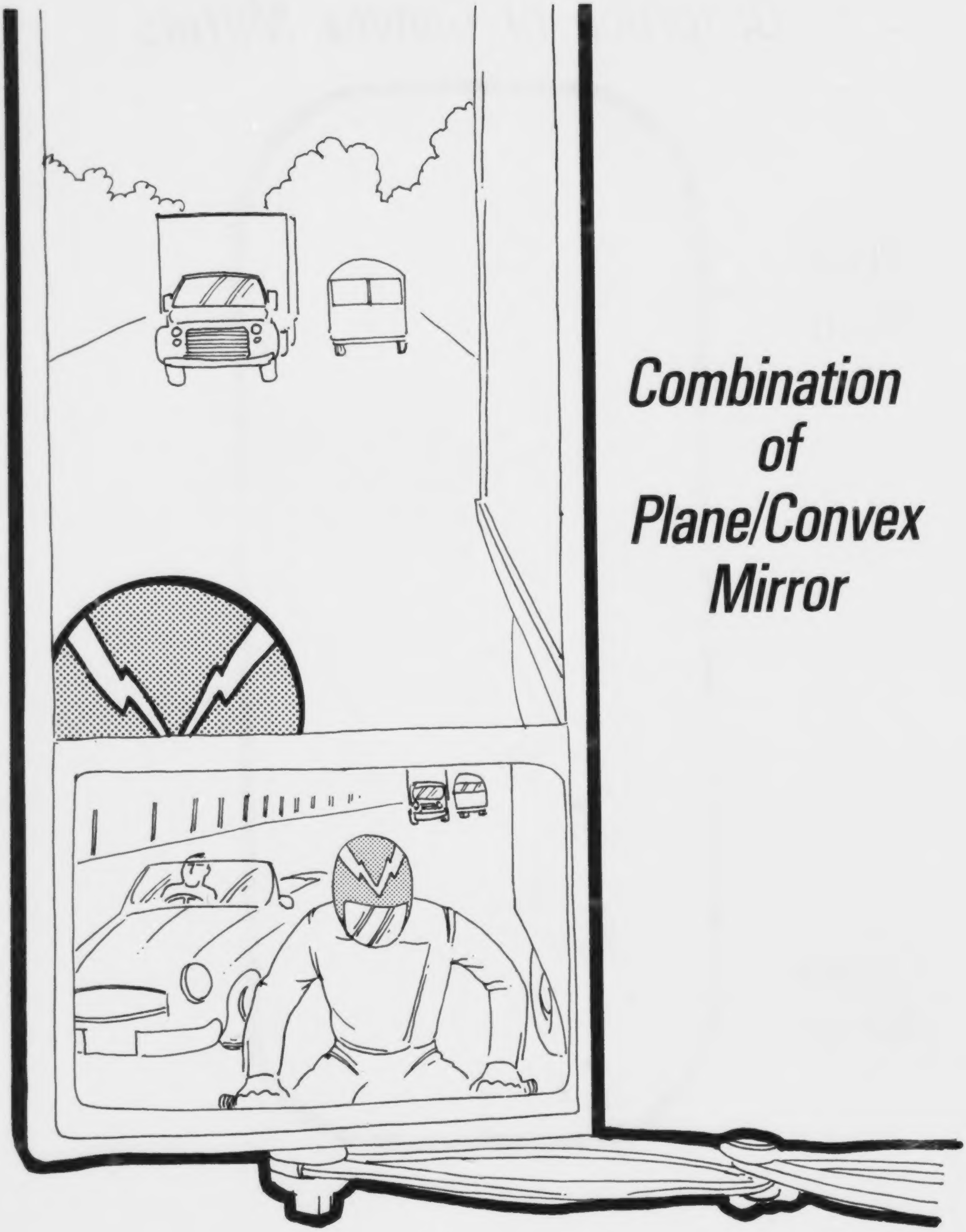
Visual 6

Field of Vision—Using a Convex Mirror


Driver
Convex Mirror View
Blind Spot Area
Convex Mirror View
Plane Mirror View
Plane Mirror View

Distortion of Convex Mirrors

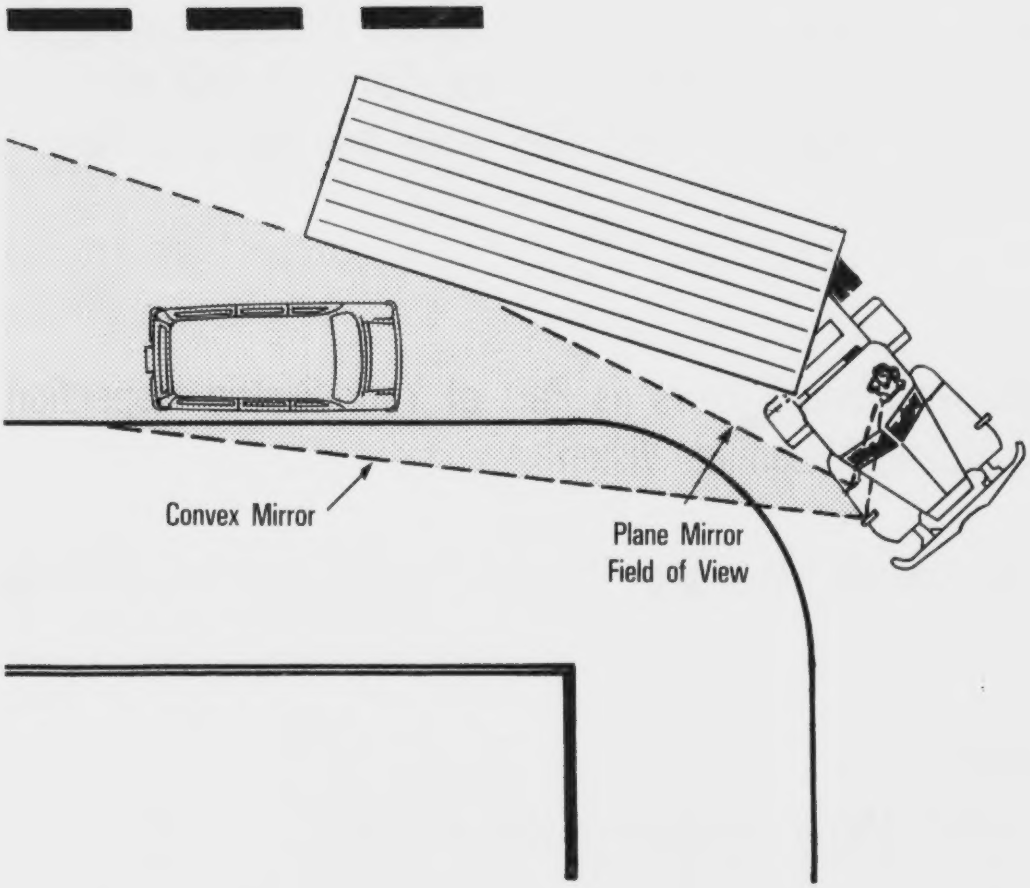

Plane Mirror
Convex Mirror



Combination of Plane/Convex Mirror

Visual 9

Field of Vision of Wide Angle Auxiliary Mirror, While Making A Right Turn


Convex Mirror
Plane Mirror Field of View

Rearview Mirror Care

Adjustment

- Learn Proper Adjustment (Focus) of Both Left and Right Side Convex Mirrors, to Obtain Maximum Rear/Side Vision

- Always Check for Proper Adjustment Before Leaving the Terminal – Don't Wait Until You Get in Traffic to Discover That You Can't See What You Need to See

Cleaning

- Always Clean Mirrors as Part of Your Pretrip Inspection, to Obtain Maximum Vision

- Use Heated Mirrors to Prevent Fogging and Ice Build Up

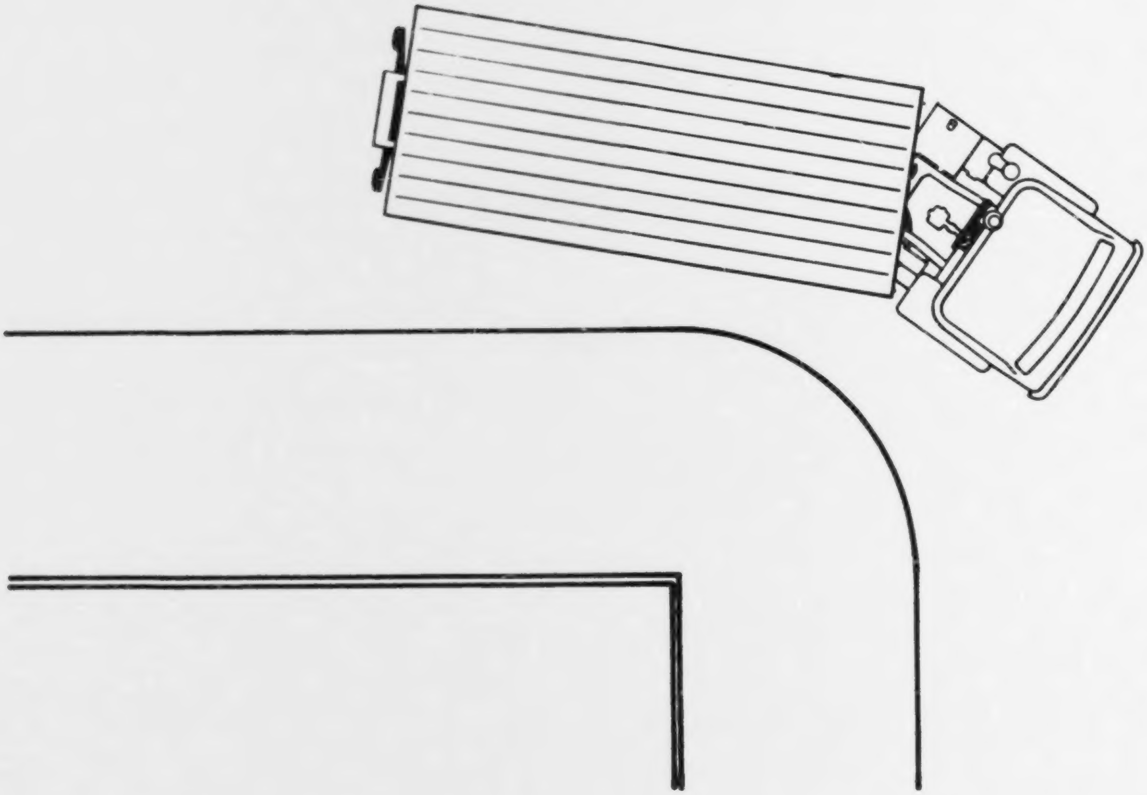
Vibration

- Protect Mirror Hardware From Damage

- Keep Hardware Properly Adjusted to Prevent Excessive Vibration

Visual 11

Problem-Solving Exercise Number 3
Field of View



Visual 12

What to Look for in Rear

- Load and Load Securement
- Loose or Falling Cargo
- Tire Fires
- Adjacent Vehicles
- Escape Route
- Collison

Use of Mirrors When Changing Directions

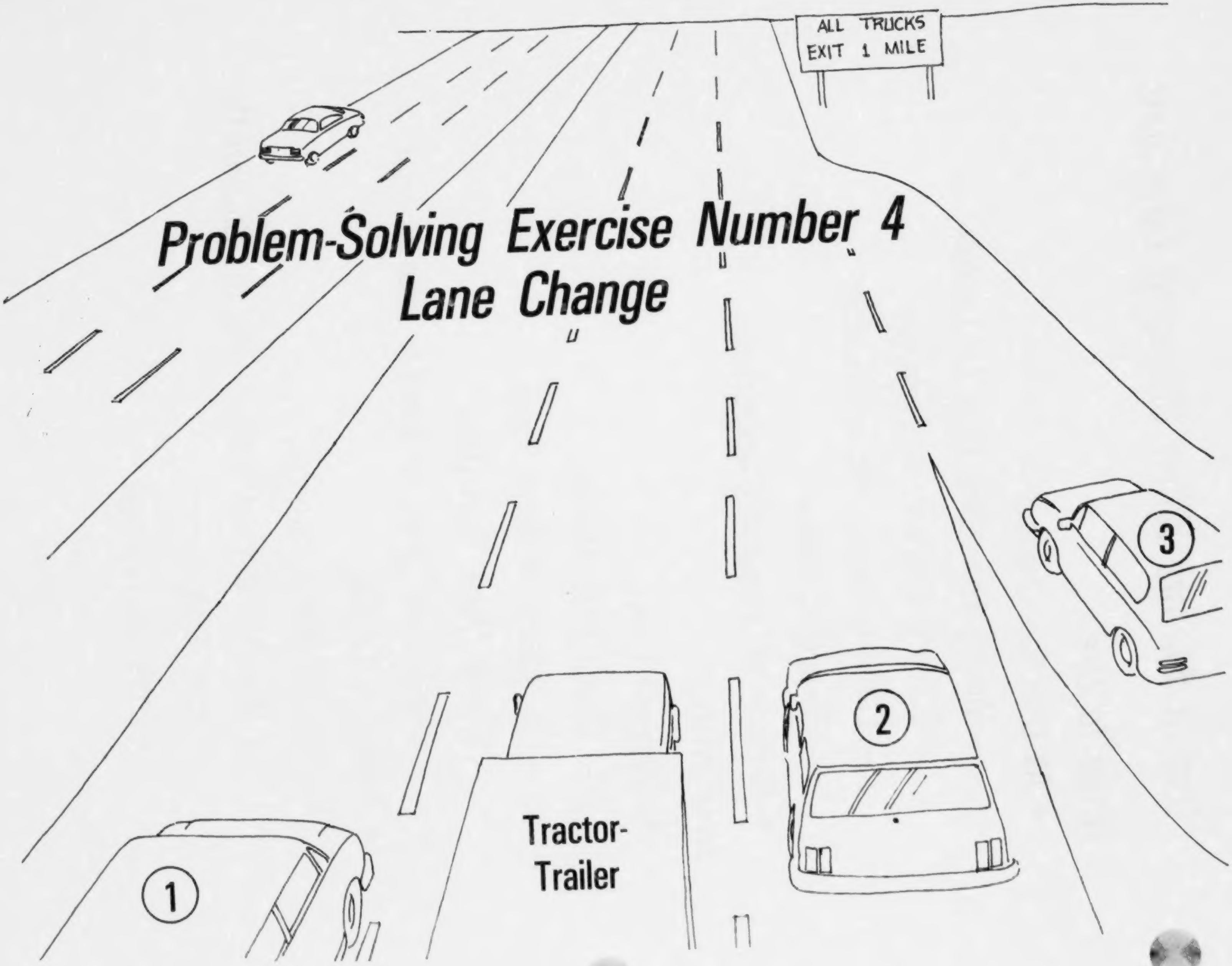
When to Use

- All Direction Changes
  - Moving From One Lane to Another
  - Entering Freeway or Highway
  - Entering From Curb or Shoulder
  - Turning a Corner
- Slowing or Stopping Unexpectedly

How to Use

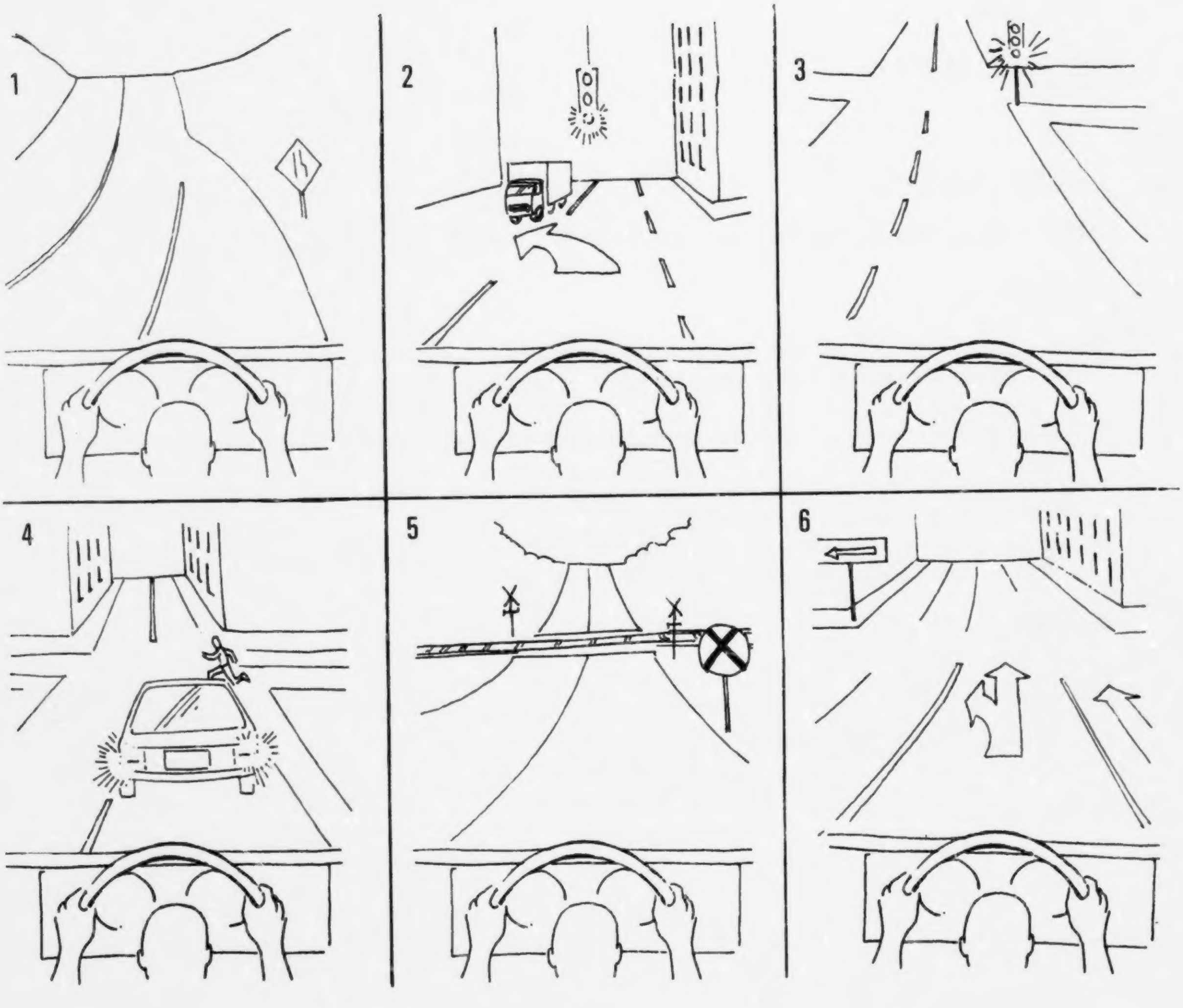
- Changing Lanes
  - Check Both Mirrors
  - Be Aware of Blind Spots
  - Check More Than Once
  - Make Sure There Is Enough Time to Look
- Turning a Corner
  - Check While Turning
    - Watch Out for Others Trying to "Squeeze By"
  - Check After Turn
    - Look for Damage

Problem-Solving Exercise Number 4
Lane Change


ALL TRUCKS
EXIT 1 MILE
1
Tractor-
Trailer
2
3

Visual 15

Examples of Commentary Driving Situations



LESSON 2 USE OF MIRRORS (LAB)

Overview

Time Alloted: 45 minutes

Prerequisites: Unit 2.1, Lesson 1

Purpose:

The purpose of this lesson is to enable students to practice adjusting vehicle mirrors used for search activities. Additionally, the students will practice interpreting the view reflected from a convex mirror.

Materials

Instruction Aids

None

Student Material

Mirror Adjustment Procedures, in Unit 2.1 of Student Manual

Equipment

Rubber traffic cones and short pieces of 2x4 lumber nailed together to form on L shape simulating a corner of a sidewalk at an intersection

Tractor-trailer which should be equipped with Westcoast type mirrors on both sides
Convex mirrors mounted below each plane (Westcoast) mirror or else on the fender if a conventional type cab
An additional convex mirror mounted above left side convex mirror to permit student to see upper front end of trailer

Content

Activity or Topic	Approximate Time
1. MIRROR ADJUSTMENT EXERCISE	45 minutes

1. MIRROR ADJUSTMENT EXERCISE (45 minutes)

Purpose

To develop the ability to adjust all mirrors in order to perform search activities.

Range Layout

Vehicles should be positioned so that the view to the rear is unobstructed.
Tractor and trailer must be in a straight line.
Mirrors should be placed out of adjustment before each student enters tractor cab.
The student must be seated in the driver seat of the tractor cab.

Directions

Divide students into groups of three. Assign each group to one instructor/vehicle.
Instruct the students to do the following:

One student takes a position behind the wheel.

The other two students will act as reference objects for proper mirror adjustment; one student should stand approximately 100 feet to the rear and 15 feet to the left side of the trailer. The second student should stand 100 feet to the rear and 15 feet to the right side of the trailer.

Adjust mirrors following proper procedure, as described in the morror Adjustment Procedures List.

Have the student that is behind the wheel make judgments about the distance of objects (e.g., traffic cone, boards) in the mirror field of view.

Repeat exercise until all students have been behind-the-wheel at least twice.

Observation

The instructor will observe for failure to perform the following procedures:

Left Side Mirrors

Plane

Position mirror so that the inside vertical edge (approximately 3/4 inch) reflects the trailer body.

The remaining portion should reflect a view of the area to the rear and 15 feet to the left side of the trailer.

Convex

Position mirror so that the inside vertical edge (approximately 3/4 inch) reflects the trailer body.

Top horizontal edge (approximately 1/2 inch) should reflect a view overlapping the plane mirror by 5 feet and extending to the end of the trailer.

Right Side Mirrors

Plane

Position mirror so that the inside vertical edge (approximately 3/4 inch) reflects the trailer body.

The remaining portion should reflect a view of the area to the rear and 15 feet to the right of the trailer.

Convex

Position mirro so that the inside vertical edge (approximately 3/4 inch) reflects the trailer body.

Top horizontal edge (approximately 1/2 inch) should reflect a view overlapping the plane mirror by 5 feet and extending to the end of the trailer.

Fender Mirrors

Adjusts to reflect a view same as convex (above)

Memorizing Image

Have student view correct adjusted mirror from right side of cab
Instruct them to remember this image so that mirror can be adjusted from right side of the vehicle without necessity to run back and forth to the driver's seat

Evaluation

Student performance will be evaluated against the following criteria:

Student adjusts mirrors following correct procedure
Student makes accurate distance and location judgments

UNIT 2.1 MIRROR ADJUSTMENT PROCEDURES

Left Side Mirrors

Plane

The inside vertical edge of the mirror (approximately 3/4 inch - 1 inch) should reflect the trailer body;* the remaining portion of the reflected view should be at least 15 feet to the left side.

Convex

The inside vertical edge should reflect a portion of the trailer, the top horizontal edge should reflect a view overlapping the plane mirror by 5 feet and extending to the end of the trailer.

Right Side Mirrors

Plane

The inside vertical edge of the mirror (approximately 3/4 inch - 1 inch) should reflect the trailer body; the remaining portion of the reflected view should be at least 15 feet to the right of the trailer.

Convex

The inside vertical edge should reflect a portion of the trailer, the top horizontal edge should reflect a view overlapping the plane mirror by 5 feet and extending to the end of the trailer.

Fender Mirrors

Convex Fender Mirrors (right/left)

adjusted to see trailer tires, curbs, and other objects when turning

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* Remember: All mirrors should be adjusted to show some part of the vehicle (trailer body, tires) in order to gain a reference point for judging the position of other reflected images.

LESSON 3 APPLICATION OF VISUAL SEARCH (STREET)

Overview

Time Allotted: 8 hours

Prerequisites: Unit 2.1, Lesson 2 and Unit 1.8, Lesson 3

Purpose:

The purpose of this lesson is to allow students to practice visual search behavior under highway and traffic conditions. The vehicle will be operated through a variety of situations requiring the search practices taught in Lesson 1. Students will go out in three-person teams per vehicle/instructor. Each student must receive a minimum of 2.5 hours of BTW time.

Materials

Instruction Aids

None

Student Material

Unit 2.1 Visual Search Checklist, in Student Manual Rules for Onstreet Driving, in Unit 1.1 of Student Manual

Equipment

Eye-movement monitoring mirror, mounted on sun visor or panel over the windshield in front of the student driver

Content

Activity or Topic	Approximate Time
1. SEARCH ACTIVITY - LOW DENSITY ENVIRONMENT	4 hours
2. SEARCH ACTIVITY - MODERATE DENSITY ENVIRONMENT	4 hours
	8 hours

1. SEARCH ACTIVITY: LOW DENSITY TRAFFIC (4 hours)

Purpose

The purpose of this activity is to allow students to apply visual search practices in a street environment relatively free from other traffic.

Route

The route to be employed in this lesson should expose the student to a broad range of roadways under low density traffic conditions. The student's relative lack of experience in operating onstreet, in the presence of other traffic, could produce distraction and anxiety. Since practice of search activities is not dependent upon the presence of other road users, the lack of traffic will not prevent attainment of objectives. At a minimum, the route should include the following:

Path Obstructions that force a change in speed or direction, and which are observable at a distance (e.g., traffic lights, lane drops, barricades).

Intersections at which right/left turns may be made.

Blind Intersections (side traffic concealed by trees, buildings, etc.) at which the driver both has and must yield the right-of-way.

Multi-lane streets that permit lane changes to be made.

Freeway interchanges, including weave-type interchanges (used to enter, exit, and traverse).

Lane Control signs and signals.

Tight Turns, such as alleys or driveways.

Directions

In addition to the general practices for onstreet sessions described in the Introduction, section of this manual, this lesson will employ the following procedures:

1. The students will operate for no more than 20 minutes at a time. Because of their lack of onstreet experience and the intensity of the activity involved, long periods behind the wheel are likely to be counter productive due to fatigue.

2. For each 20 minute driving session, students will devote from 1/4 to 1/2 the time employing commentary driving techniques to describe potential hazards. The instructor and observer students will use the information to assess the driver's search pattern and record it on the Visual Search Checklists.

3. Instructions involving changes of speed or direction will be given well in advance of a maneuver in order that the instructions themselves will not serve as a cue for required search behavior.

4. The instruction will direct the students to perform the following specific maneuvers at various points along the route:

   Lane change: This is best done by alternating turns onto and off of a multi-lane road, e.g., a left turn followed by a right turn. The instructor should not have to request a lane change, thereby cueing search behavior

   Tight turn: The student should be instructed to turn into a driveway or alley in order to force a speed reduction where following traffic would not ordinarily expect it.

   Right and left turns, at controlled and uncontrolled intersections, both having and yielding right-of-way.

   Entering, leaving, and traversing freeway interchanges.

Observations

The instructor and observer students will observe and record driver errors in basic control (Unit 1.8) and search activity using the checklists provided. Each error will be recorded by placing a checkmark next to the behavior that was performed incorrectly.

Since the driver's search behavior cannot be observed directly, it must be inferred from one or more of the following:

Commentary

Student descriptions of potential hazards should be used only as a way of determining where students are looking, not what they are seeing. For example, a student preparing to make a left turn may correctly identify oncoming vehicles as a potential hazard but be in error for not searching the path to the left.

Eye/Head Movements

Search behavior that requires movement of the driver's eyes and/or head may be observed by the instructor and by use of the eye-movement mirror. Where observers cannot see the mirror, their observations would be restricted to those student behaviors that require head movement.

Speed/Direction Changes

The driver's response to a situation in the path ahead that requires a change in speed and/or direction is an indication that the situation has been observed. Failure to respond does not necessarily indicate driver error since the driver may have observed the situation and not recognized it as requiring action. However, it should be treated as a possible error to be discussed later in the critique of student performance.

The error categories described on the instructor and student checklists are as follows:

Distance Scanning

Failure to respond to a visible requirement for a speed or direction change, at least 12 seconds in advance. Situations would include the following:

- Red light
- Red flashing light
- Warning sign
- Lane drop
- Barricade or other obstruction
- Parked vehicle (in travel lane)

Turn Path

Failure to search the path ahead in a right or left turn.

Roadside Scanning

Failure to respond to signs over or alongside the road, including:

- Posted speed limits
- Lane control signs and signals
- Warning signs

Blind Intersection, Privileged

Failure to slow and search for cross traffic when approaching a blind intersection as the privileged vehicle (having the right-of-way).

Blind Intersection, Burdened

Failure to move to a position where cross traffic can be seen when stopped at a blind intersection as the burdened vehicle (the vehicle that must yield the right-of-way).

Mirror Usage, General

Failure to observe right and left rearview mirror at least every 5 to 8 seconds (more frequently in tight situations)

Mirror Usage, Slowing

Failure to check the right and left rearview mirrors before slowing where following drivers would not anticipate it (e.g., tight turn, parallel parking).

Mirror, Lane Change

Failure to use the rearview mirror in the direction the lane change is to be made before initiating the lane change.

Mirror, Merge

Insufficient or excessive monitoring of rearview mirror prior to merging onto a highway from an access or acceleration lane.

Positioning, Merge

Failure to align the tractor and trailer sufficiently parallel to the main highway to be able to observe through traffic on the main roadway prior to a merge.

2. SEARCH ACTIVITY: MODERATE DENSITY TRAFFIC (4 hours)

Purpose

The purpose of this activity is to allow students to apply search practices under traffic conditions requiring a moderate degree of attention-sharing.

Route

The route employed in this lesson should expose students to the same range of conditions described in the previous activity. However, the routes selected should be characterized by moderate volume of traffic. At this point in the curriculum, high density (e.g., rush hour) traffic should be avoided in order to not to impose a burden with which the student is not yet prepared to cope, and in order to avoid long traffic delays.

Directions and Observations

The procedures employed in carrying out the activity, and the observations of driver performance to be made are the same as those previously described in SEARCH ACTIVITY: LOW DENSITY TRAFFIC. The same instructor and student checklists will again be used.

UNIT 2.1 VISUAL SEARCH CHECKLIST

If a driver makes a driving error in one of the categories below, place a tally mark in the box.

BASIC CONTROL ERRORS	Driver #1	Driver #2	Driver #3
Acceleration			
Braking			
Stopping			
Upshifting			
Downshifting			
Uphill Operation			
Downhill Operation			
Speed Adjustment/Curves			
Lane-Keeping/Straight			
Lane-Keeping/Turns			
Lane-Keeping/Curves			
VISUAL SEARCH			
Distance Scanning			
Turn Path Search			
Roadside Scanning			
Blind Intersection, Privileged			
Blind Intersection, Burdened			
Mirror Usage, General			
Mirror Usage, Slowing			
Mirror Usage, Lane Change			
Mirror Usage, Merge			
Positioning, Merge			

An explanation of errors is provided on the back.

Explanation of Driver Errors on Unit 2.1 Checklist

Distance Scanning--Failure to respond to a visible requirement for a speed or direction change, at least 12 seconds in advance. Situations would include the following:

- Red light
- Red flashing light
- Warning sign
- Lane drop
- Barricade or other obstruction
- Parked vehicle (in travel lane)

Turn Path Search--Failure to search the path ahead in a right or left turn.

Roadside Scanning--Failure to respond to signs over or alongside the road, including:

- Posted speed limits
- Lane control signs and signals
- Warning signs

Blind Intersection, Privileged--Failure to slow and search for cross traffic when approaching a blind intersection as the privileged vehicle (having the right-of-way).

Blind Intersection, Burdened--Failure to move to a position where cross traffic can be seen when stopped at a blind intersection as the burdened vehicle (the vehicle that must yield the right-of-way).

Mirror Usage, General--Failure to observe right and left rearview mirror at least every 5-8 seconds.

Mirror Usage, Slowing--Failure to check the right and left rearview mirrors before slowing where following drivers would not anticipate it (e.g., tight turn, parallel parking).

Mirror, Lane Change--Failure to use the rearview mirror in the direction the lane change is to be made before initiating the lane change.

Mirror, Merge--Insufficient or excessive monitoring of rearview mirror prior to merging onto a highway from an access or acceleration lane.

Positioning, Merge--Failure to align the tractor and trailer sufficiently parallel to the main highway to be able to observe through traffic on the main roadway prior to a merge.

Notes:

Notes:

UNIT 2.2
COMMUNICATION

UNIT 2.2 COMMUNICATION

PURPOSE

The purpose of this unit is to enable drivers to communicate their presence and intentions to other road users.

OBJECTIVES

Performance Objectives

Student must

- signal intention to change position on the road before pulling onto or off of the road or changing lanes.
- cancel turn signals after trailer is around the corner and straightened out.
- time signals so that they are not confusing to other drivers.
- flash brake lights to warn following drivers that the tractor-trailer is slowing or stopping.
- use four-way flashers according to State laws and company policies.
- use headlights in daytime under conditions of low visibility.
- position vehicle where it can be seen by other drivers.
- make selective use of horn and lights to prevent collisions.
- limit use of CB radio to communications that will enhance safety and traffic flow, especially when engaged in other maneuvers.
- establish eye contact with drivers or pedestrians that may enter your path of travel.
- avoid entering the path of other vehicles on the basis of a signal.

Knowledge Objectives

Students must know

- when to actuate turn signals to provide adequate warning without creating confusion.
- State traffic laws concerning turn signals.
- importance of signaling to the prevention of accidents.

- importance of not giving signals that lead to the assumption of liability (e.g., inviting others to pass).
- importance of using horn to give warning and not using it for other purposes (e.g., intimidation).
- conditions under which other drivers may give false signals.

Skill Objectives

None

Attitude Objectives

Students must believe that

- signaling one's intention is essential to avoiding collisions and traffic violation convictions.
- signaling at all times is necessary to develop proper signaling habits.
- improper use of horn is dangerous and can cause problems with public relations.
- improper use of the CB is potentially dangerous, possibly illegal and creates a poor industry image.

LESSONS

Lesson 1.	**Principles of Communication (Classroom)**	**1 hour 15 minutes**
Lesson 2.	**Application of Communication (Street)**	**3 hours**

LESSON 1 PRINCIPLES OF COMMUNICATION (CLASSROOM)

Overview

Time Allotted: 1 hour 15 minutes

Prerequisites: Unit 2.1, Lesson 1

Purpose:

The purpose of this lesson is to present and discuss the basic principles of communication. The importance of signaling is discussed, as well as the correct safe and legal methods of signaling to communicate intent, including use of turn indicators, warning flashers, and vehicle position.

Communicating presence by the proper use of lights and horns is also discussed. Improper horn use and CB use, and reading the communications of others is also discussed. The lesson ends with several problem-solving exercises to reinforce the key ideas. The lesson also prepares students to be evaluated on their communication procedures (signaling, etc.) during road lessons.

Materials

Instructional Aids

Visuals 1-11

Student Material

Federal Motor Carrier Safety Regulations which apply to this unit
Communication Checklist

Instructor Material

No additional material required.

Content

Activity or Topic	Approximate Time
1. COMMUNICATING INTENT	20 minutes
2. COMMUNICATING PRESENCE	20 minutes
3. MISUSE OF COMMUNICATIONS	5 minutes
4. COMMUNICATIONS FROM OTHERS	5 minutes
5. PROBLEM-SOLVING EXERCISES	25 minutes
	1 hour 15 minutes

1. COMMUNICATING INTENT (20 minutes)

Introduction

Definitions

Communicating intent: Letting others know in advance what you plan to do

Basic Methods

Using turn signals
Altering position of vehicle
Flashing brake lights
Warning flashers

Always communicate intent to change direction

Other drivers expect you to go in same direction
Need to let them know when you intend to do something different

Signal even when no one is around

It reinforces the habit
Most dangerous vehicles are the ones you don't see
    Vehicle in blind spot may start to pass

Visual 1 Tractor-Trailer Changing Lanes, Making Turns

Signal When Changing Position in Traffic

When You Plan To

Turn
Change lanes
Pass another vehicle
Merge
Parallel park
Leave the curb

Four Basic Rules for Signaling

1. Signal in advance, but don't signal too early
2. Signal just before maneuver
3. Keep signal on for length of maneuver
4. Cancel the signal promptly when the maneuver is over

Signal in Advance

Can't see vehicles in blind spots
Must give them plenty of warning

Give enough time so people can read your message and react
    One-half block before an intersection
    500 feet on open highway

Legal Requirements

- FMCS requirement is 100 feet (392.15)
- States vary from 100 feet to 500 feet in advance
- Many legal requirements are just bare minimum, e.g., 100 feet may not be safe enough

Don't Signal Turns Too Early

- Signaling too early may lead another driver to assume an early turn
- Driver may pull into your path
- EXAMPLE: If you have to turn into an alley beyond an intersection, don't signal until in the intersection

Signal Just Before Maneuver

- When not pressed, wait until the path is clear to signal the lane change
  - Don't continue to signal a lane change if you can't make it
  - Driving with a signal on and not executing a move is confusing
- When traffic is heavy, a signal may induce other drivers to give way

Keep Signals on During the Entire Maneuver (Other than Passing)

- Make sure the maneuver is complete before turning signal off - shouldn't take hands off wheel to cancel
- Keep in mind the length of rig and how long it takes to complete turn

Cancel Signals

- Make sure signals are canceled after safely completing maneuvers
  - Double check self-canceling signals
  - Signals left on are confusing and dangerous to following traffic
- Cancel before shifting
  - Cancel signal before reaching for gear shift lever
  - Establishes an association between canceling and shifting
  - Helps to develop a canceling habit

Signal by Position Change

- Drivers in blind spot may not see signal

- Can communicate intention by small position change
  - Enough to show intent
  - Not enough to cause a hazard
- Procedure
  - Gradually ease toward the desired lane
  - Pause for a few seconds
  - Continue lane change

Visual 2 Tractor-Trailer Slowing Down or Stopping

Signal Turns to Slow Down or Stop

- Warn other drivers when you will slow down or stop unexpectedly
- Flash brake lights
  - Lightly touching the brake will flash brake lights
  - Flashing brake lights will attract more attention than continuous light
  - Flash trailer body lights rapidly in sudden stops
  - Emergency flashers may suffice for less urgent stops

Situations When Other Drivers Don't Expect You to Slow Down or Stop

- Slowing or stopping in the middle of a block
- Getting ready to park or turn
- Approaching stalled traffic or something in road that traffic behind can't see

Keep the Size of Your Vehicle in Mind

- Difficult for following drivers to see ahead of large tractor-trailers
- Makes it particularly important to signal when traffic necessitates slowing

Importance of Signaling

- Car drivers unfamiliar with tractor-trailer maneuvers
- Important to let following vehicles know what's happening
  - Others don't expect you to pull left to make a right turn
  - They don't expect you to pull out across several lanes of traffic in order to back into a tight spot
  - They expect the trailer to follow same path as the tractor

Visual 3 Tractor-Trailer Giving a False Signal - Making Turn From Wrong Lane

Avoid False Signals

- Position of vehicle can give false signal
  - Moving left before a right turn gives a false signal

  - Small vehicle can attempt to pass and become trapped between larger vehicle and right hand curb
  - Correct position for right turn will be described in Unit 2.4, Managing Space

Recap

Communicating intent important for safety and courtesy

Safety

- Vital to let the other driver know when changing speed/direction
- Alerts other drivers to problems they can't see

Courtesy

Helps other driver avoid being trapped in wrong lane

EXAMPLE: Driver stuck behind someone turning left who didn't signal

2. COMMUNICATING PRESENCE (20 minutes)

Definition: Letting others know where you are

Methods

Horn
Headlights
Warning signals

Visual 4 Use of Horn to Communicate

Using Horn to Communicate Presence

Use light taps on electric horn to gain attention i.e., establish eye contact with other driver or pedestrian
Signal early, before an emergency develops

Situations in Which to Communicate with Electric Horn

Bicylist, pedestrian, driver at a cross street looking in other direction
Driver ahead getting ready to change into your lane
Adjacent driver signaling entry to lane you are already entering

What Communicating Presence Says to Others

Alerts others so they will avoid sudden moves into your path
Alerts drivers of situations with potential conflicts
Gives others time to react to avoid the conflict
Research has shown that accidents can be reduced with proper communications, e.g., gives the person who is making the dangerous move time to react safely.

Using Horn to Communicate Danger

Air horn is extremely loud
Use frightens other road users
Loud blasts for immediate danger only

Sudden Reaction to Loud Horn Blasts

Causes other road users to react suddenly and make a sudden move
EXAMPLE: Blasting your horn while passing a vehicle on right
Tendency is for driver to move into your path
Early warning makes loud blast unnecessary

Types of Emergencies When You Should Use Long Blast of Horn

- When quick response is needed
  - Children or other pedestrian, or vehicle suddenly starts into vehicle's path
  - Brakes fail or vehicle is out of control

- When electric horn can't be heard
  - Oncoming driver preparing to pass a vehicle ahead of him
  - Driver of noisy vehicle (e.g., farm or construction vehicle)
  - Workers in construction area

Summary

- Be alert to situations in which it appears that other drivers are not aware of your presence
- Use the horn lightly to communicate your presence and to give other time to react
- Use long blasts in emergency situations only

Visual 5 Illustration of Federal light Requirements

Use Lights to Communicate Presence

Requirements of Federal Law (FMCSR 393.13, 393.14, 393.25, 393.26)

- Tractor--Front
  - Headlights and double face turn signals
  - Identification and clearance lamps on top of vehicle

- Tractor--Rear
  - Reflectors on each side
  - Stop lamp (activated by service brakes)
  - Taillights

- Trailer--Front
  - Clearance lamps on left and right top

- Trailer--Side
  - Clearance lamps at front and rear
  - Reflectors at bottom front and rear
  - Intermediate side marker lamps and reflectors if 30 ft. plus

- Trailer--Rear
  - Clearance lamps on outside top
  - Identification lamps at center
    - Closed trailer--top
    - Open trailer--bottom
  - Reflectors on left and right rear bottom
  - Turn signals, stop lamps and taillights inside of reflectors

- Color
  - Lamps to the front of vehicle should be white or amber
  - All other turning signals and stop lamps--red
  - Side markers and reflectors--amber
  - Side markers and reflectors near rear side--may be red
  - All rear lights and reflectors--red and amber taillights permitted

Visual 6 Communicating Presence

Situations When You Should Use Lights to be Seen

- Turn headlights and clearance/identification lights on
  - During early morning dusk
  - Gray days
  - Bad weather conditions
    - Rain
    - Fog
    - Snow
  - When oncoming drivers have sun in their eyes
- Use lights when having trouble seeing other vehicles
  - Other drivers probably have trouble seeing you
  - Almost invisible without lights
  - Visible much sooner with lights on
- Use low beams

When to Use Headlights to Communicate Instead of Horn

- When lights are on, flash them instead of using horn
- Lights communicate presence in nonemergency situations

Visual 7 Warning Signal

Use of 4-Way Flashers

- Used to communicate presence of vehicle in certain situations

- Nighttime roadside stops
  - Hazardous to be stopped at road side with just taillights on
  - May not be seen
  - Other drivers may try to follow you

- Prolonged stops.
  - Some States require or restrict use of flashers when parked temporarily in business district to load or unload

- Emergency stops
  - Use warning flashers immediately
  - Absolutley necessary if vehicle obstructs traffic

  - Slow moving vehicle
    - When traveling at below minimum speeds
      - Minimum speeds vary with States
      - Typically 40 mph on 55 mph roads
    - Subject to State and Federal laws
      - Use is required in some situations
      - Permitted or restricted in others
      - Students need to find out requirements of States in which they will travel
      - Information available in State Driver's Manual.

Recap

Check laws on use of 4-way flashers
Improper use can confuse other drivers

Flares and Reflective Triangles

- Necessary when
  - Stopped on road at any time
  - Stopped on shoulder at night
- Placement
  - Far enough back to allow approaching drivers ample time to react
- To be discussed in Unit 5.4, Accident Procedures

3. MISUSE OF COMMUNICATIONS (5 minutes)

Drivers Frequently Misuse Communications By

- Guiding others
- Misusing horn
- Misusing CB radio

Guiding Others

Visual 8 Aerial View of Passing Situations

Signaling others that it is safe to pass or enter traffic is not legal

Do not give any kind of signals that it is safe to pass or cross
- Federal (and most State) regulations prohibit it
- May make driver and/or employer liable for accident

Visual 9 Driver Blasting Horn

Horn

Don't Socialize (Say Hello) With Your Horn

- Unsafe and distracting

Don't Use The Horn or Noise From Air Brakes to Express Your Emotions

- In anger or frustration
- To bulldoze or bully other traffic
- Consequences
  - Frightened drivers could panic and react causing an accident
  - You could be held responsible

Horn Should Be Reserved For Two Things

- Communicating presence to avoid danger
- Warning of immediate danger

CB Radio

A good communications tool if used safely and legally,
Distracting and dangerous if improperly and illegally used.

Legitimate Uses

- To provide information about weather and traffic conditions
- To aid or provide information about accidents or other emergencies
- To obtain directions and other local information

Unsafe Uses

- Idle chatter
    - Distracts driver
    - Ties up one hand
- During maneuvers requiring both hands
    - Turning
    - Shifting

Illegal Uses

- To inform others that it is safe to speed
- Profanity

4. COMMUNICATIONS FROM OTHERS (5 minutes)

Signals from Others

Visual 10 City Street - Signals From Others

React and Adjust to Communications of Others

- People
    - Driver movement in vehicle indicates possible direction change
        - Shifting in seat
        - Looking at mirror
    - Eye contact reduces chances of sudden maneuver
        - Drivers and pedestrians (e.g., intersections)
        - Do not trust eye contact completely; they may think you plan to yield

- Speed and position changes of other vehicles
    - Sudden unexpected slowing may indicate direction change
    - Slight position change may precede a turn or lane change
- Signals from vehicles
    - Exhaust
    - Turned front wheel

Many Drivers Signal Improperly

- Not in time or too soon
- No signal at all
- Fail to cancel signal

Need to Recognize Other Signs Which Indicate Speed or Direction Change

EXAMPLE: Vehicle getting ready to turn but not signaling
Changes position to the lane for turning
Slows speed

Caution: Be ready to change position or speed; check other traffic

Recap

The professional driver is alert to communications of others
Anticipates and avoids conflict

5. PROBLEM-SOLVING EXERCISES (25 minutes)

Two problem-solving exercises follow in which students apply and discuss communications principles.

Visual 11 Tractor-Trailer Signaling to Pass

Problem 1. Application of Basic Rules for Signaling

Ask students to outline the correct observation and communication practices in the passing maneuver illustrated.

As each point is presented, the student must state why it is important in terms of safety.

List of Steps and Importance

1. Check Mirror
   Is it safe to make this passing maneuver? Are the adjacent lanes clear? Check before signaling.

2. Signal in Advance
   Signals should be given 500 feet in advance to warn following drivers, drivers in blind spot, drivers in other lanes, etc.
   Don't signal until you are sure you can make the maneuver or you will confuse other drivers. This principle applies more to right and left turns as most drivers do not signal too early to pass.

3. Check Mirror Again
   Is it still safe?

4. Move Left
   Signal by position change. Move far enough to
   Take portion of adjacent lane
   Avoid striking unseen vehicle

5. Check Mirror Again
   Is it still clear?

6. Keep Signal on Throughout Maneuver
   Important to communicate to other drivers throughout a traffic maneuver as you are changing speed and position. Passing is actually two maneuvers so the process is completed twice.

7. Cancel Signal When Maneuver is Over
   Failure to do so will confuse drivers.

Remove Visual

Problem 2. Discussion of Problems Created by Poor Communciations

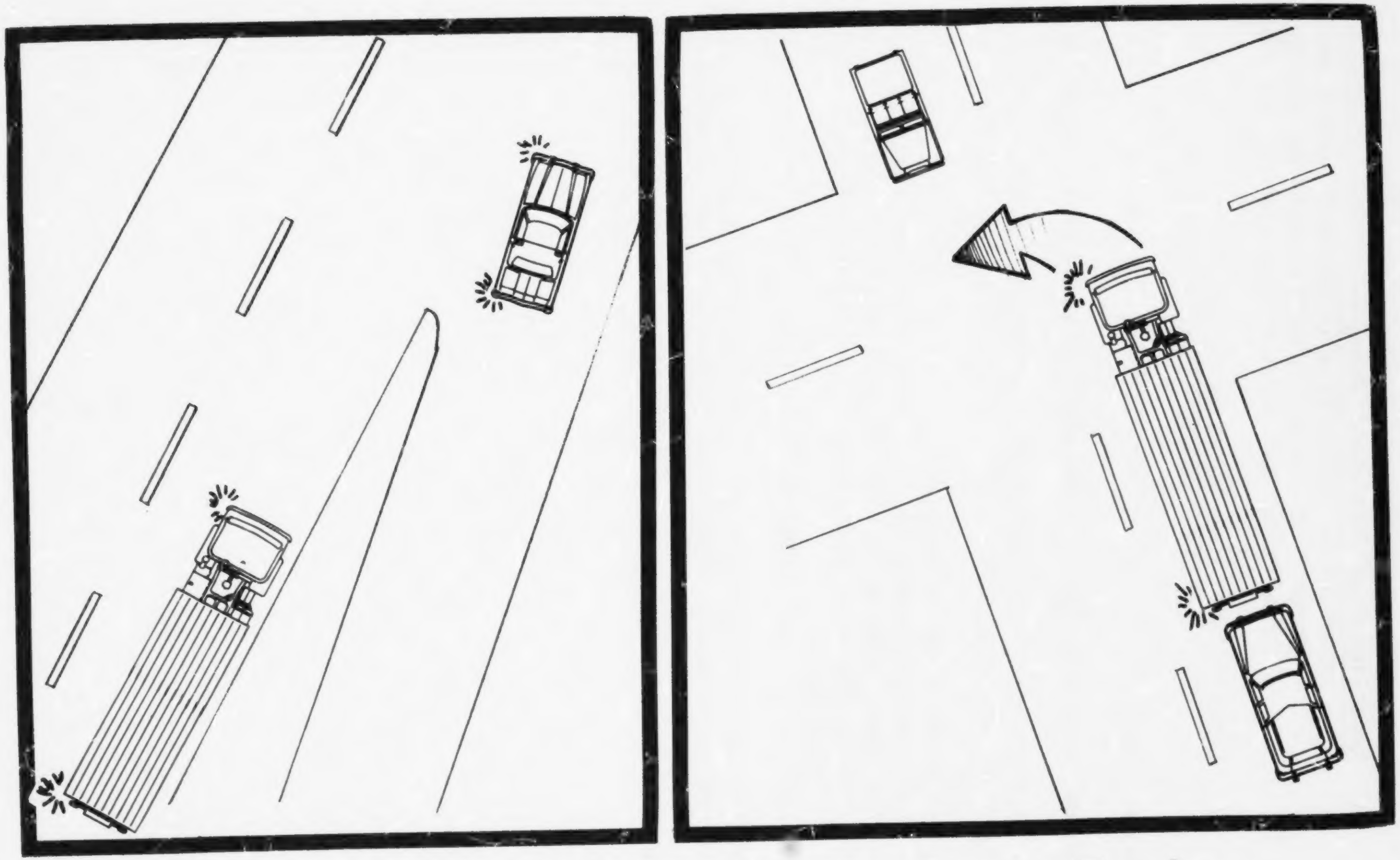
Ask students to give examples of poor communication that they have observed by other drivers, particularly tractor-trailer operators.

Try to obtain examples showing
- Failure to communicate (e.g., not signaling lane change)
- Not communicating in time (e.g., signaling turn too late)
- Sending the wrong signal (e.g., position in traffic signals wrong intention)
- Improperly using communications (e.g., blasting horn unnecessarily)

Ask students to identify traffic conflicts (near misses or accidents) which occurred as a result of faulty communications they observed.

Visual 1

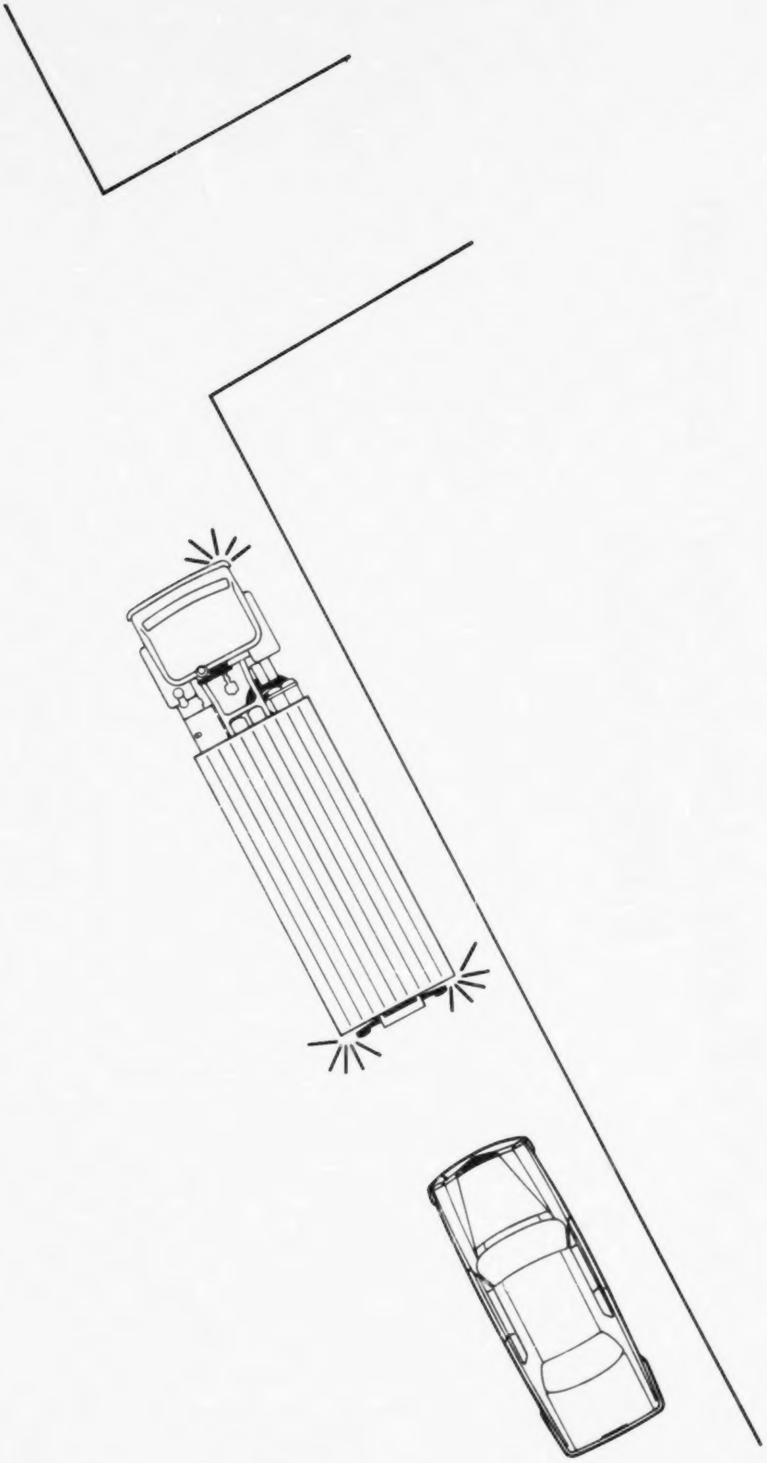
Communicate Your Intent



When Changing Lanes, Merging, Passing, or Turning

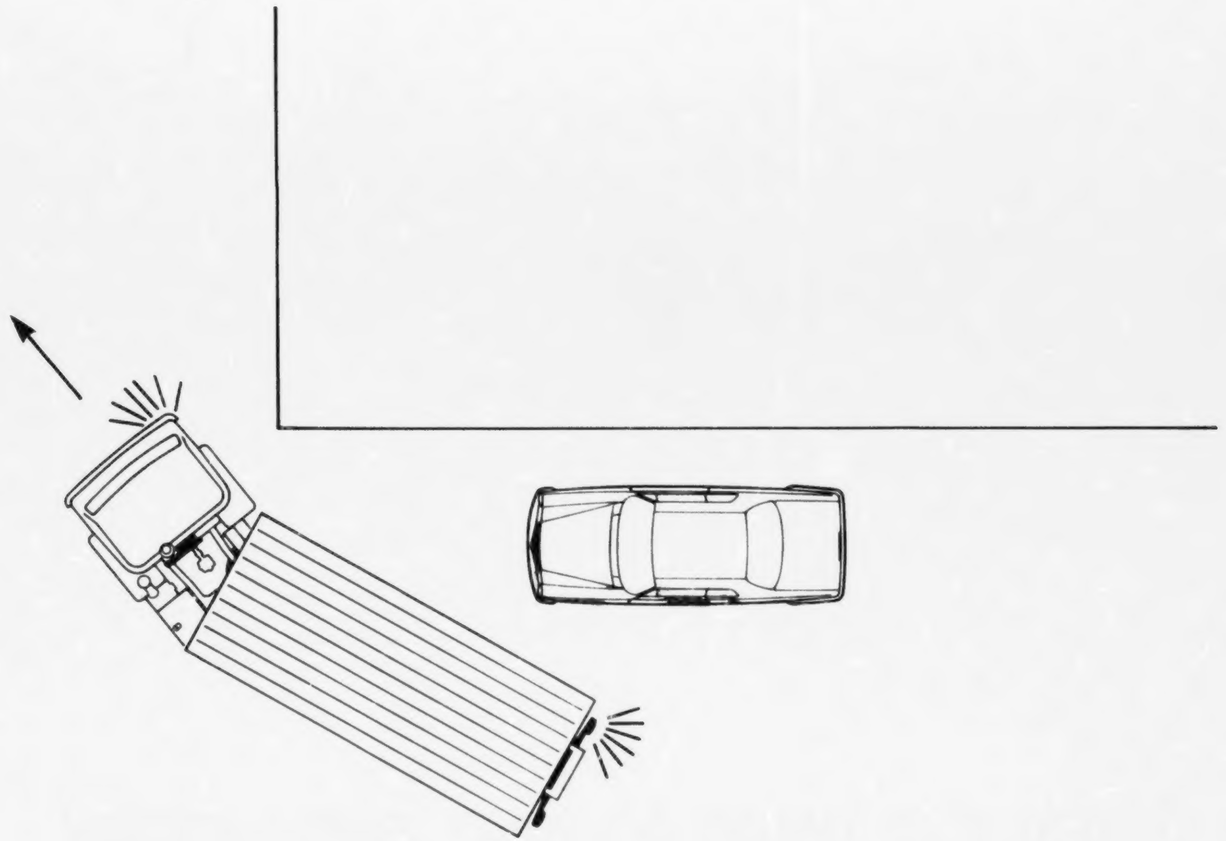
Visual 2

Tractor-Trailer Slowing Down or Stopping

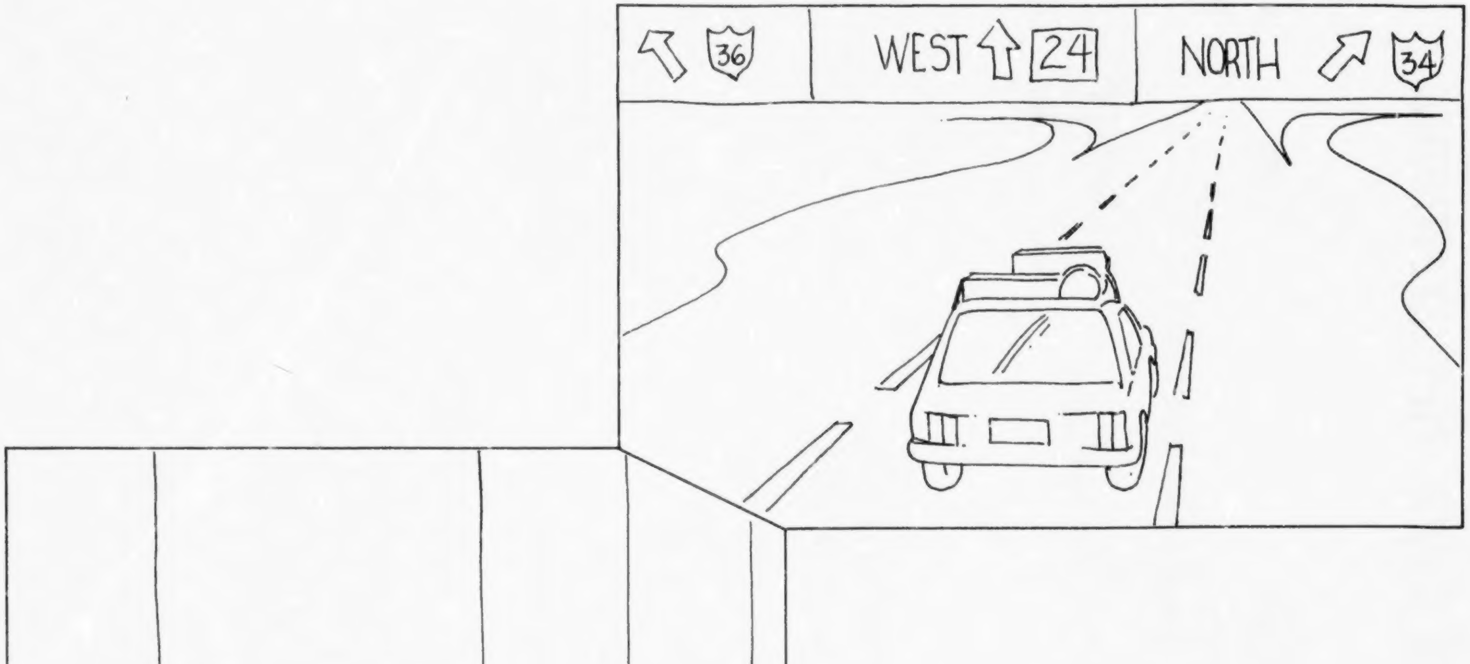


Visual 3

Tractor-Trailer Making Right Turn From Wrong Position

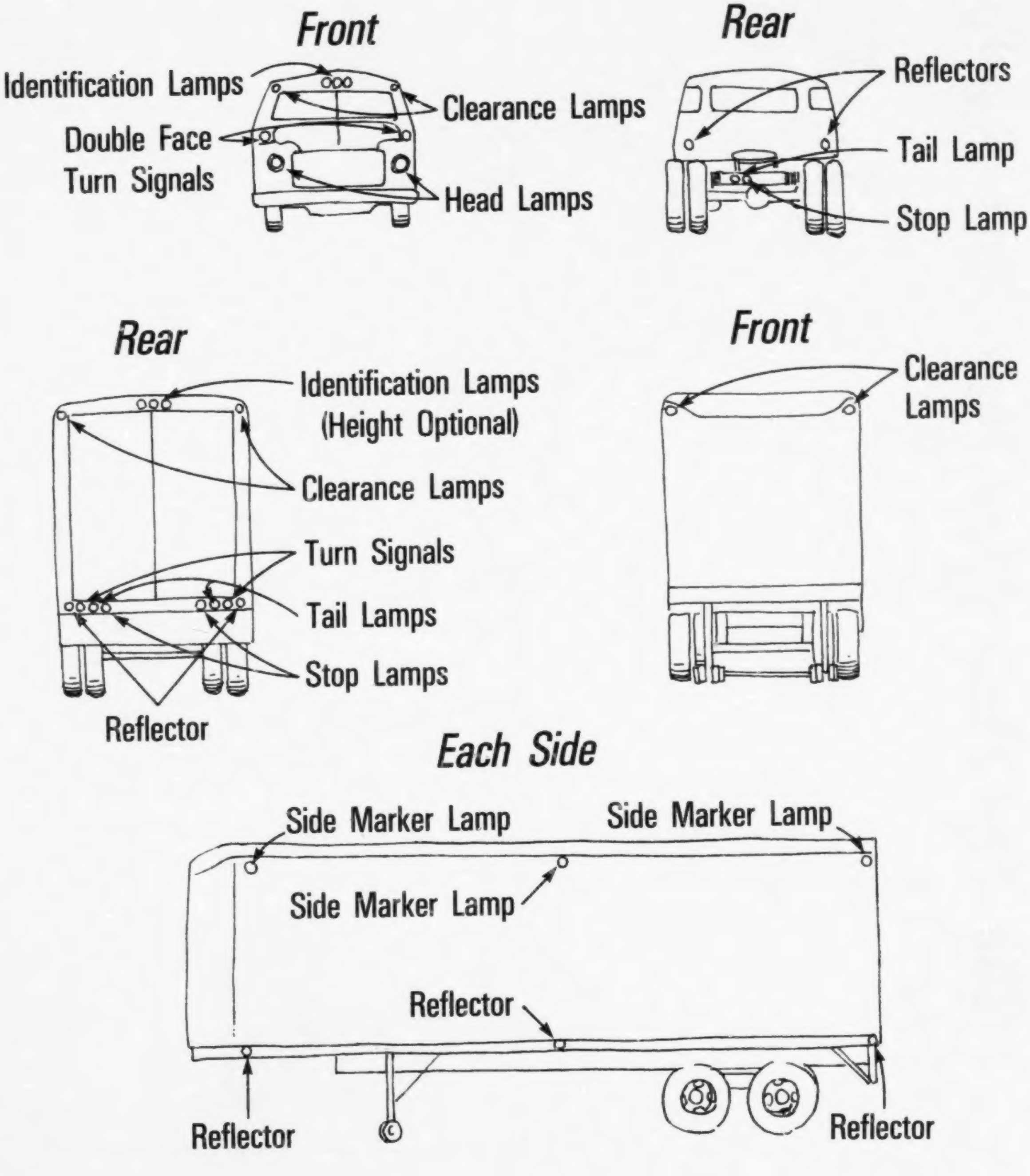


Use Your Horn When They Don't See You

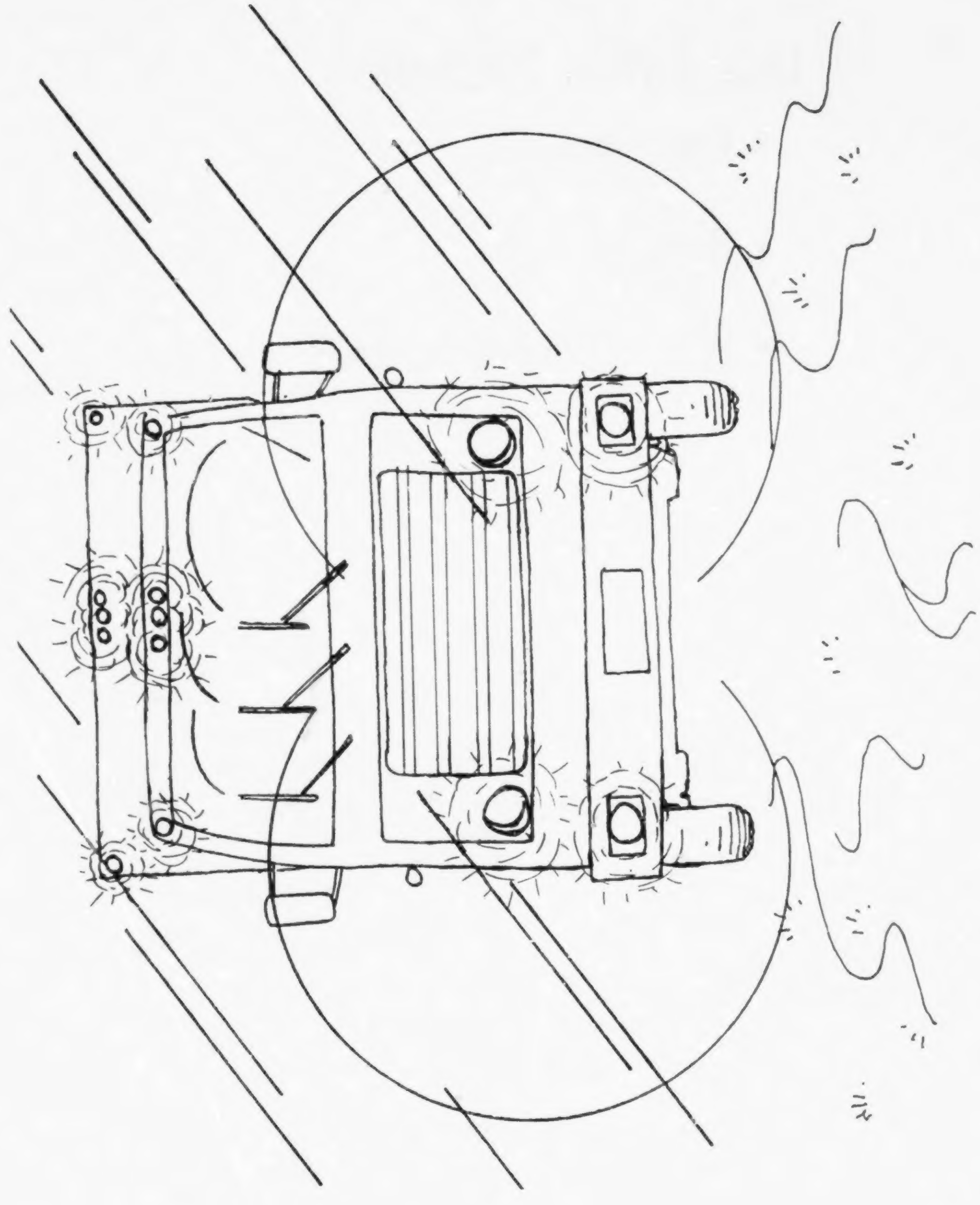

36
WEST
24
NORTH
34

Visual 5

Federal Light Requirements


Front
Identification Lamps
Clearance Lamps
Double Face Turn Signals
Head Lamps
Rear
Reflectors
Tail Lamp
Stop Lamp
Rear
Identification Lamps (Height Optional)
Clearance Lamps
Turn Signals
Tail Lamps
Stop Lamps
Reflector
Front
Clearance Lamps
Each Side
Side Marker Lamp
Side Marker Lamp
Side Marker Lamp
Reflector
Reflector
Reflector

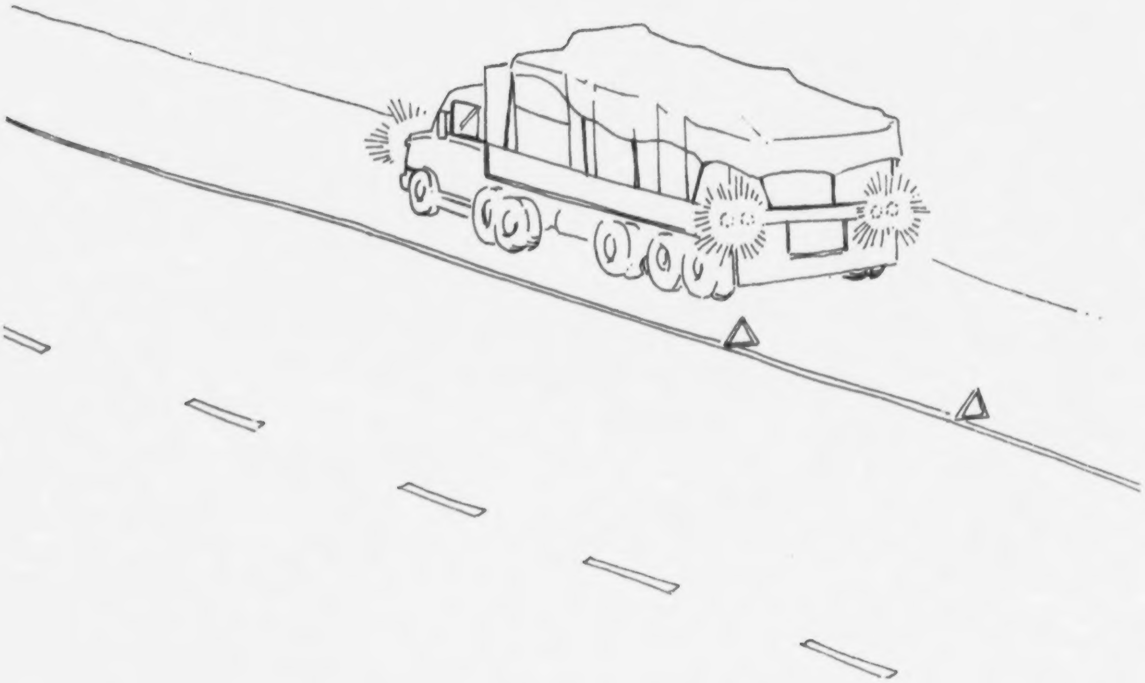
Communicate Your Presence



Warning Signal

Use 4-Way Flashers

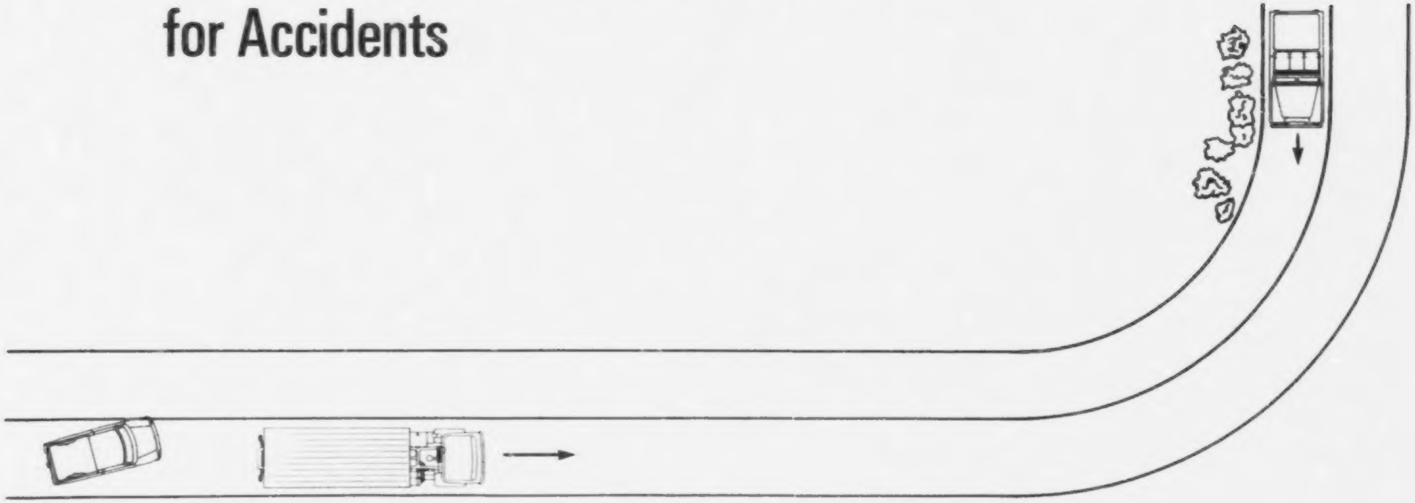
- Emergencies
- Backing
- When Required by LAW!



Avoid Guiding Others

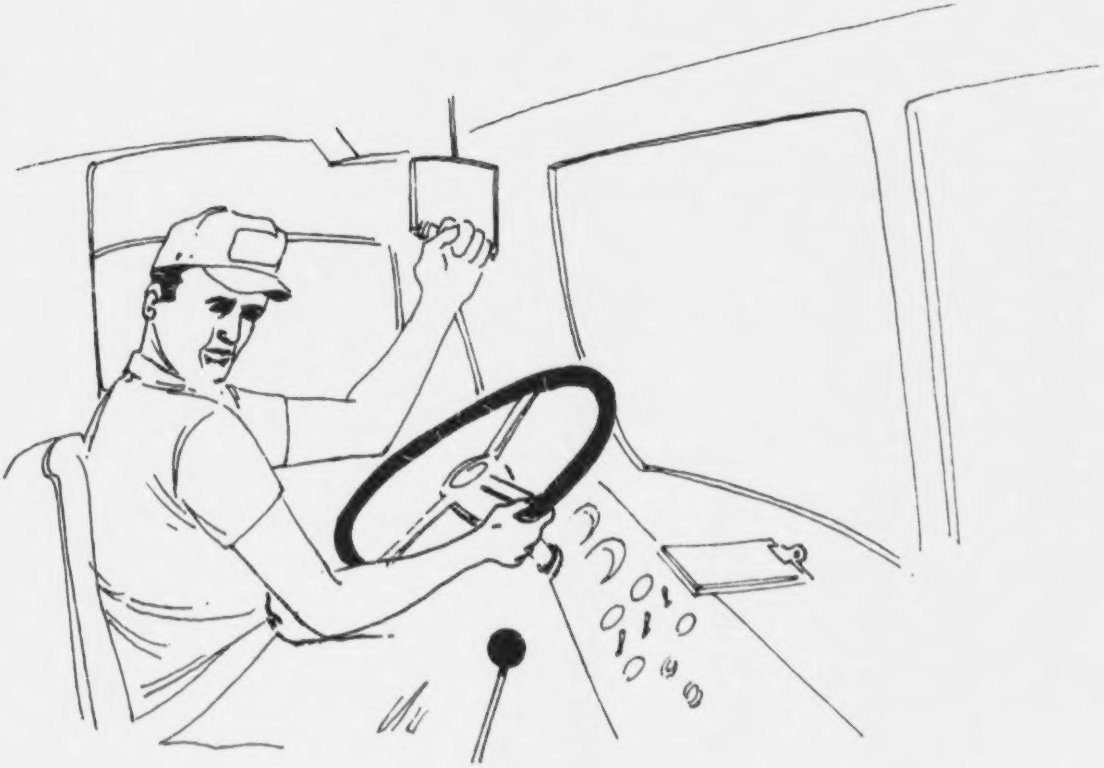
Do Not Signal Others to Pass or Cross

- It's Against the Law
- Your Employer Could Be Held Liable for Accidents



Horn

- Don't Socialize
- Don't Bully Others



CB Radio

- No Idle Chatter
- No Illegal Information

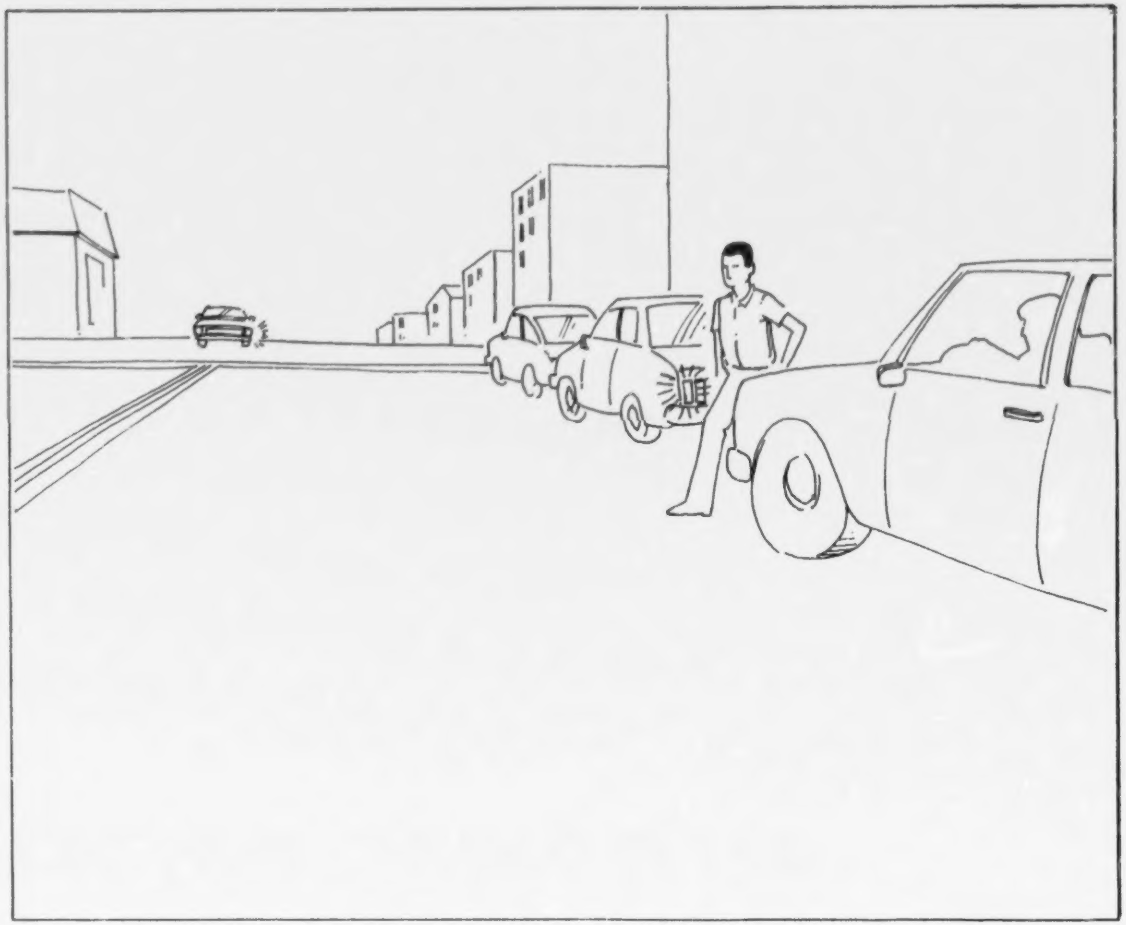
Communications From Others

People

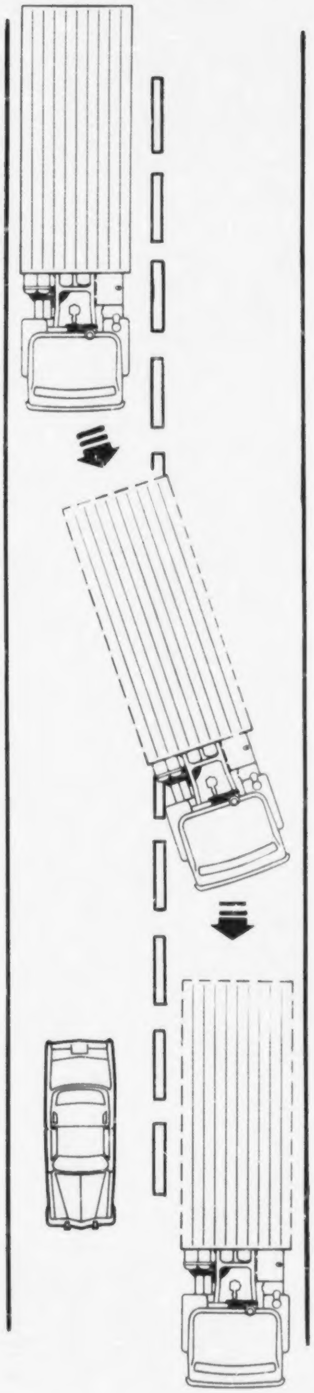
- Driver Movement
- Eye Contact

Vehicles

- Position
- Speed change
- Wheels
- Lights
- Exhaust



Tractor-Trailer Signaling to Pass



LESSON 2 APPLICATION OF COMMUNICATION (STREET)

Overview

Time Allotted: 3 hours

Prerequisites: Unit 2.1, Lesson 3

Purpose:

The purpose of this lesson is to allow students to apply the communication procedures taught in the classroom lesson. Students will operate over routes requiring many turns and lane changes. Students will be observed and rated for use of both communication practices and the visual search practices taught in Unit 2.1. Students will go out in three-person teams per vehicle/instructor. Each student must receive a minimum of one hour of BTW time.

Materials

Instructional Aids

None

Student Material

Unit 2.2 Communication Checklist, in Student Manual

Rules for Onstreet Driving, in Unit 1.1 of Student Manual

Instructor Material

Unit 2.2 Communication Checklsit (at end of lesson)

Content

Activity or Topic	Approximate Time
1. COMMUNICATION ACTIVITY	3 hours

1. COMMUNICATION ACTIVITY (3 hours)

Purpose

The purpose of this activity is to allow students to apply communication practices within the highway traffic environment.

Route

The route chosen for this lesson should meet the general characteristics and permit the maneuvers described in Street Lessons for Units 1.8 and 2.1. However, a greater number of turns and lane changes should be called for in order to provide opportunities for both greater use of turn signals and practice in performing turning maneuvers. Alternating right and left turns onto and off of multi-lane roads provides opportunities to turn and necessitates lane changing maneuvers.

Directions

No special procedures beyond those described in the Introduction of this manual are required.

Observations

Student and instructor should observe and record errors in carrying out basic control, search and communication behaviors using the checklists provided. Communication errors are as follows:

- Signaling Turns--errors in signaling right and left turns at intersections
  - None--failure to activate the signal at any point in the turn
  - Late--failure to activate the signal before reaching the intersection
  - Early--misleading other road users by an early signal
- Canceling--failure to cancel a signal properly
  - Late--canceling more than 5 seconds after a turn is completed
  - Early--canceling the signal while in a turn
- Lane Changing--errors in signaling lane changes.
  - None--failure to activate the signal at any point in the lane change
  - Late--failure to activate signal soon enough before starting lane change
  - Innappropriate--signaling a lane change when there is no gap to move into and enough time to wait for a gap to appear

Position--failure to use vehicle position to communicate intention to change lanes

Flashers--failure to activate emergency flashers when slowing or stopped as provided for by State law

Brake Lights--failure to flash brake lights when slowing or stopping unexpectedly, including:

- Stalled traffic ahead
- Midblock (e.g., alley)
- Prior to parallel parking

Use of Horn--errors in using electric or air horns

Insufficient--failure to use horn under appropriate circumstances

Improper--using the horn improperly or using the wrong horn

Interpreting Communication--errors involving recognition and interpretation of communication from others

Receiving--failure to react and adjust to communications of others

Misinterpreting--misinterpreting communications from others reacting accordingly

Students should also note signaling lapses of other drivers as they occur, and comments upon the hazard they represent to other road users

Notes:

UNIT 2.2 COMMUNICATION CHECKLIST

If a driver makes a driving error in one of the categories below, place a tally mark in the box.

	DRIVER		
BASIC CONTROL	#1	#2	#3
Acceleration			
Braking			
Stopping			
Upshifting			
Downshifting			
Uphill Operation			
Downhill Operation			
Speed Adjustment/Curves			
Lane-Keeping/Straight			
Lane-Keeping/Turns			
Lane-Keeping/Curves			

	DRIVER		
VISUAL SEARCH	#1	#2	#3
Distance Scanning			
Turn Path Search			
Roadside Scanning			
Blind Intersect., Priv.			
Blind Intersect., Burd.			
Mirror Usage, General			
Mirror Usage, Slowing			
Mirror Usage, Lane Ch.			
Mirror Usage, Merge			
Positioning, Merge			

	DRIVER		
COMMUNICATION	#1	#2	#3
Signaling Turns: None			
Late			
Early			
Lane Changing: None			
Late			
Inappropriate			
Position			
Canceling: Late			
Early			
Flashers			
Brake Lights			
Use of Horn: Insufficient			
Improper			
Interpreting Communications Receiving			
Misinterpreting			

An explanation of errors on the Communication Checklist is provided on the back.

Explanation of Driver Errors on Unit 2.2 Checklist

Signaling Turns--errors in signaling right and left turns at intersections

None--failure to activate the signal at any point in the turn

Late--failure to activate the signal before reaching the intersection

Early--misleading other road users by an early signal

Canceling--failure to cancel a signal properly

Late--canceling more than 5 seconds after a turn is completed

Early--canceling the signal while in a turn

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Receiving--failure to react and adjust to communications of others

Misinterpreting--misinterpreting communications from others reacting accordingly

UNIT 2.3
SPEED MANAGEMENT

UNIT 2.3 SPEED MANAGEMENT

PURPOSE

The purpose of this unit is to enable students to manage vehicle speed effectively in response to various conditions.

OBJECTIVES

Performance Objectives

Students must

- adjust speed to the configuration and condition of the roadway; weather and visibility conditions; traffic conditions; and vehicle, cargo and driver conditions.
- obey the legal speed limit.

Knowledge Objectives

Students must know

- the relationship of speed to stopping distance, hydroplaning, crash severity, ability to maneuver, and fuel economy.
- the effect on maximum safe speed of vehicle weight, center of gravity, loss of stability, available sight distance, and road surface conditions.

Skill Objectives

Students must be able to judge maximum safe speed

- at which a curve can be entered.
- that traction will permit.
- at which vehicle control can be maintained under crosswinds, limited visibility, and limited traction.

Attitude Objectives

Students must believe that

- driving proficiency cannot compensate for speed that is excessive in prevailing conditions.
- there are situations where any speed may be too fast for conditions.

- adhering to the national maximum speed limit--55 mph--is beneficial to the nation and cost-beneficial to the driver, the employer, and the trucking industry.

- an excessive number of speeding violations may result in loss of employment.

LESSONS

Lesson 1.	**Speed Management Principles (Classroom)**	**2 hours**
Lesson 2.	**Speed Management Demonstration (Range)**	**1 hour 45 minutes**

LESSON 1 SPEED MANAGEMENT PRINCIPLES (CLASSROOM)

Overview

Time Alloted: 2 hours

Prerequisites: Unit 2.2, Lesson 1

Purpose:

The purpose of this lesson is to fully explain the principles of speed management and to discuss situations and conditions that require the driver to adjust speed. The safety and fuel economy benefits of the 55 mph speed limit will also be presented and discussed.

Evaluation of student speed management skills should be part of each over-the-road driving lesson.

Materials

Instructional Aids

Visuals 1 to 19

Student Material

No additional material required.

Instructor Material

No additional material required.

Content

Activity or Topic	Approximate Time
1. SPEED AND STOPPING DISTANCE	20 minutes
2. SPEED AND SURFACE CONDITIONS	15 minutes
3. SPEED AND THE SHAPE OF THE ROAD	25 minutes
4. SPEED AND VISIBILITY	15 minutes
5. SPEED AND TRAFFIC FLOW	10 minutes
6. OBEYING THE SPEED LIMIT	20 minutes
7. CLASS DISCUSSION: PROBLEMS CREATED BY SPEED	15 minutes
	2 hours

1. SPEED AND STOPPING DISTANCE (20 minutes)

Importance of Speed Management

Speeding is Major Cause of Fatal Traffic Accidents

Definition of Speeding
Exceeding legal or posted speed limit
Driving too fast for conditions

Conditions for Adjusting Speed

Visual 1 Conditions Affecting Safe Speed

Four Conditions Affect Maximum Safe Speed.

Traction
Traction refers to the tire's grip on road
Decreased traction means increased stopping distance
Adjust speed to conditions that decrease traction (slippery road)

Visibility
Must be able to stop within distance you can see
Adjust speed to conditions that interfere with visibility (rain, fog, snow, and darkness)

Traffic Conditions
Need to maintain a safe space cushion in traffic
Adjust speed to volume and flow of traffic to keep a safe cushion

Roadway Characteristics
Shape of road affects traction and visibility
Adjust speed for curves and hills

Vehicle speed is most critical factor in stopping distance.

Two Parts of Stopping Distance

Braking Distance
Driver Response Time

Visual 2 Stopping Distance Chart

Braking Distance

Braking Distance A Function of

Brake "lag" distance--the distance the vehicle travels during the time it takes the compressed air to reach the individual brake chambers

Effective braking distance--the distance the vehicle travels after the brake make contact with the drums or disks.

Three Key Vehicle Factors Affect Braking Distance

Vehicle speed
Vehicle weight
Conditon of braking components

- Higher the vehicle speed the longer the braking distance
  - More energy is built up at higher speeds
  - More energy has to be dissipated in order to stop vehicle
  - Energy is dissipated in the form of heat from brakes

- Vehicle weight also increases braking distance
  - Posted speed limits often lower for trucks than cars
  - Takes longer for heavier vehicles to stop
  - Fully loaded vehicles cannot stop as quickly as unloaded vehicles

- Vehicle components in poor condition can add to braking distance
  - Tires
  - Brakes
  - Air supply

Comparison of Braking Distance by Vehicle Speed and Weight

Weight

- Mass
  - The greater the weight, the greater the mass that must be stopped
  - The greater the mass, the longer the stopping distance required
- Traction
  - The greater the weight on the tires, the greater the traction
  - The greater the traction, the shorter the stopping distance
- Net effect
  - With heavily loaded trailer, stopping distance is generally increased
  - With unloaded trailer, stopping distance is shorter but tires "hop" or jump up and down, which may increase the stopping distance

Speed

- Braking distance increases disproportionally to speed and weight
  - Speed increased two times from 20 to 40 mph
    - Car braking distance increased four times from 25 to 105 feet.
    - Tractor-trailer braking distance increased 6.5 times from 50 to 320 feet
  - Rate of increased braking distance gets higher at higher speeds

Tractor-trailer increases speed three times from 20 to 60 feet
Braking distance increases almost ten times from 50 to 465 feet

Condition of Braking System

Key braking parts are brakes and tires.

Brakes
- Worn brake shoes/pads reduce friction
- Reduced friciton increases braking distance
- Misadjusted brake system components increase stopping distance

Tires
- It is friction of tire against pavement that stops vehicle
- Will be discussed more fully in Skid Control and Recovery (Unit 3.3)
- Limit to tire friction available
- Worn tread reduces friction and increases stopping distance on wet roads

Air Supply
- Longer it takes air to reach brakes, the greater the stopping distance
- Delay in air supply caused by
  - faulty compressor
  - bent, crimped or leaking air lines

Driver Needs to Know The Equipment
- Condition and type of brakes can affect braking distance
- Best equipment, in best shape, cannot compensate for excessive speed

Visual 3 Response Time and Distance Traveled

Driver Response Time

Includes Perception and Reaction Time

Perception--time it takes to identify hazard
Reaction--time it takes to decide and act

Greater the Speed: The Greater the Distance Traveled as Driver Responds

Distance traveled in 1 second
- 20 mph = 29 feet
- 40 mph = 59 feet
- 60 mph = 88 feet

Easy formula that all dirvers must learn:
- Divide mph by two and add to mph to get feet per second
- EXAMPLE: 40 mph ÷ 2 = 20
  - Add 20 to 40 = 60
  - Close to 59 feet which is the mathematically correct answer

Average driver's reaction time is 3/4 of a second

Adds fixed amount of distance traveled at each speed
- 3/4 second equals 55 feet traveled at 50 mph.
- 55 plus 320 equals 375 feet total stopping distance

Slow driver perception and/or reaction times might be difference between near miss and accident
- Tired, drinking or distracted driver
- Poor visual search habits
- Stopping distance is increased

Good or excellent reflexes cannot compensate for required stopping distance
- Above 20 mph major part of stopping distance is the braking distance
- Cannot be cut down with good reflexes

Stopping Distance

Note: Using the lower half of Visual 3, show students how the braking distance plus the response distance add up to create total stopping distance.

Recap

Stopping distance includes driver response time and braking distance
Speed greatly increases stopping distance
Driver reflexes cannot compensate

2. SPEED AND SURFACE CONDITIONS (15 minutes)

Friction and Traction

Visual 4 Stopping Distance: Wet and Dry Pavement

Definition

Friction--resistance between two surfaces

Traction is a form of friction
- Enables tires to grip road when moving
- Reduced traction increases stopping distance
- Loss of traction means loss of vehicle control
- Cause: Sudden stops and locked wheels

Types of traction:
- Static - Vehicle at rest - most traction
- Rolling - Vehicle in motion - less traction
- Sliding - Wheels locked and sliding - least traction (more details on this covered in Unit 3.3)

Surface Conditions

Dry pavement--50 mph--375 feet

Wet pavement--50 mph--1,125 feet
- Allow more stopping distance on wet surfaces
  - Wet conditions can more than double stopping distance
  - Cut speed in half to keep stopping distance the same

EXAMPLE: Dry pavement--60 mph--531 feet
Wet pavement--30 mph--444 feet
Cutting speed in half keeps same stopping distance (approximately)

Know when wet surfaces are most dangerous
- E.g., first 10-15 minutes of rain on hot day (rain combines with oil and dirt to create slick mixture)
- More oil left from standing vehicles at intersections, especially slippery when it rains.

Visual 5 Dynamics of Hydroplaning

Hydroplaning

Usually takes place at high speeds during
- Heavy rain
- Standing water
- Slush conditions

Tires leave road and ride on a film of water or slush

Two types
- Dynamic
- Viscous

Dynamic

- Water cushion builds under front tires
- As speed increases, tires leave road, i.e., water skis
- Infrequent at legal speeds for loaded tractor-trailers
  - Weight of truck generally prevents dynamic hydroplaning under 55 mph
  - Can occur at front wheels of tractor when excess weight on rear axle(s) lightens front end
  - Conditions:
    - New Tires--3/8 inch water on road surface
      - 30 mph (begin to lose contact)
      - 50 mph (outer ribs touching)
      - 55 mph (all contact lost)
    - Worn tires--can occur with much less water at lower speeds
      - No tread for water to flow through
      - Water cushion builds up in front of tire much more quickly

Viscous

- Can take place on seemingly dry surfaces
- 1/25th inch of water is enough
- A heavy dew mixing with oil and dust can create the conditions
- Detection
  - Hydroplaning is very deceptive
  - Driver may not expect anything, until:
    - Gust of wind hits vehicle
    - Brakes are applied
    - Sudden shift of vehicle direction

- How to avoid hydroplaning
  - Use proper tires
  - Inflate to correct pressure
  - Reduce vehicle speed

To restore traction, slow down gradually

Visual 6 Stopping Distance: Snow and Ice

Icy or Snowy Roads

Stopping distances greatly increased

Cut Speed Drastically.

- Reduce speed on packed snow by one half
- Reduce it to a crawl on icy roads

Be Aware of Especially Slick Spots

- Packed snow and ice most slippery at 32 degrees
- Shady spots don't thaw as fast as sunny spots
- Bridges and overpasses
  - First to freeze
  - Last to thaw
  - Don't get heat from the earth like roads

Recap

Be aware of conditions that reduce traction.
Adjust speed for increased stopping distance.
Avoid sudden stops and loss of vehicle control.

NOTE: Additional information on winter driving is discussed in Unit 2.6.

3. SPEED AND THE SHAPE OF THE ROAD (25 minutes)

Adjusting Speed for Curves

Need to adjust speed to avoid skidding or loss of control.

Visual 7 Centrifugal Force

Effects on Tractor-Trailer Combination

- Centrifugal force--tractor-trailer, and cargo all want to go in a straight line
- Skid
  - In curve or turn, centrifugal force causes rig to go straight
  - If centrifugal force exceeds traction, vehicle fails to make curve or turn
  - Consequences
    - Skid off road
    - Skid into another lane
    - Skid through intersection

Will be discussed more fully in Unit 3.3, Skid Control and Recovery

- Turnover
  - Taking a curve too fast could result in turnover
    - Trailer and load tend to keep going straight
    - Tires continue around curve
    - Trailer turns over on side
  - Factors that contribute to turnover (along with speed)
    - Center of gravity (CG)
      - Refers to the height of the vehicle's mass (weight) above the ground
      - The greater the mass of the load, the higher the CG
      - The heavier the load (at any given height), the higher the CG
    - Stability of loads
      - Tankers
        - Partial loads
          - Centrifugal force causes liquid to slosh to sides
          - When liquid above CG, can result in turnover
        - Baffles
          - Partitions in tank limit the movement of liquid
          - Reduce change of turnover
      - Suspended carcasses (hanging meat)
        - Carcasses of meat suspended in refrigerated vehicle
          - In turn, centrigual force causes meat to swing to the side
          - If not properly secured, can swing hard enough to cause turnover

Livestock

- When not tightly packed, (confined) can sway to the side during a turn
  - Particularly dangerous in double or tripledeck livestock trailers
  - Each deck raises the CG

Cargo Shifting and Damage

- Driver can avoid turnover but still have damage
- Cargo shifts because of
  - excessive speed for curve
  - centrifugal force
- Results: Damage to cargo, financial losses to company and driver

Jackknife Could Result

- Trailer continues straight while tractor turns
- Causes trailer and tractor to assume angle like a jackknife
- Tractor and trailer collide
- Discussed further in Unit 3.3

Proper Method for Curves

- Anticipate changes in the shape of the road
  - Use good eye-lead time
    - Pay attention to road signs that often suggest safe speed and when to slow down
- Decelerate to safe speed
  - Slow down before curve
  - Slow down to speed that is safe to handle curve, i.e., a speed that eliminates the need to
    - Apply brakes
    - Downshift the tranmission
  - Below posted speed
    - Limit is set for cars, not trucks
    - Trucks have higher center of gravity
  - Shift into appropriate gear for speed required

- Drive through the curve at a steady speed
  - Accelerate slightly throughout to maintain drive wheels traction
  - Don't let the trailer push the tractor

- Be aware of the laws of nature
  - Braking and steering cannot compensate for affects of centrifugal force
  - These problems can be voided by using safe speed to enter curve

- Remember steering traction is reduced when braking in a curve

Visual 8 Steps for Handling Upgrades

Adjusting Speed for Grades

Gravity affects speed on upgrades and downgrades

Definition--Gravity is the force that attracts things to center of the earth.

Upgrades--working against gravity, vehicle has to work harder

Downgrades--gravity pulls vehicle down, dangerous situation for heavily loaded vehicles

Handling Upgrades

- Depends on type of engine, degree of incline and load
    - Open the accelerator smoothly
    - Select the proper gear
    - Keep an eye on temperature gauges
- Downshift (if required)
    - If engine type requires maintaining rated engine speed
        - Down shift to maintain engine speed
        - Downshift as rpm drops
        - Shift quickly to avoid excessive rpm loss and engine damage
    - Other rules for managing speed on inclines
        - Keep to the right to let faster vehicles pass
        - Be alert at approach to crest of hill
            - Visibility is blocked
            - Don't speed up until you know what is over the hill

Handling Downgrades

- Two Basic Methods of Braking
    - Engine compression used to hold weight
        - Resists motion of pistons transmitted through drive shaft to drive wheels
    - Service brakes applied to tractor and trailer wheels
- Consequences of Improper Speed Control Going Downhill
    - Overspeeding the Engine
        - Load pushes vehicle downhill
        - Governor cannot control engine speed
        - Overspeeding: 200-300 rpm over rated speed
            - Causes severe damage
            - Needs to be avoided
        - Driver should
            - Keep an eye on tachometer
            - Not let engine overspeed

Damage to Brakes

- If speed builds up too much brakes could be damaged when applied
  - Overheating
  - Brake fade
  - Loss of brakes

Loss of Vehicle Control, if speed or position not properly managed, trailer could swing over to other lane or shoulder on downhill curves.

Visual 9 Handling Downgrades

Procedures for Handling Downgrades

To be discussed more fully in Unit 2.6, Extreme Driving Conditions (Mountains)

Selecting and Using the Proper Gear

- Select the proper gear
  - Keeping engine speed at normal rpm
    - Causes air compressor to produce enough air for brake application
    - Increases resistance for more engine braking
  - Rule of thumb--use same gear (or one lower) to go down a hill as used to go up that same hill
  - When not sure of uphill gear always
    - Choose the lowest of likely gears
    - Dangerous to downshift on a downgrade
      - Very difficult to shift to lower gear
      - Can get caught in neutral
      - Vehicle is then out of control
    - Not good to upshift either
      - Can also get caught between gears
      - Road speed may increase before shift can be completed

- Timing the shift
  - Downshift at crest of hill (before starting down)
  - Avoid downshifting when going downhill

Using Brakes Properly

General

- Use service brakes aided by engine compression
- Apply service brakes smoothly
  - Don't fan or jam
  - Avoid overheating
- Do not use trailer brakes alone
- Use proper method of braking

Braking Technique

Short Steep Grades

- Selection of proper gear allows you to control speed with light brake pedal pressure
- Use light pressure constantly applied, do not apply and release, apply and release

Longer Less Steep Grades

- Proper gear selection is first steps
- Use steady and continuous pedal pressure to control engine speed

Use Engine Brakes (retarders) If Available

- Cut down need for service brakes
  - Keeps service brakes from overheating
  - Saves wear and potential damage of service brakes
- Will slow but not stop vehicle
- With proper gear selection, may make use of brakes unnecessary
- Will be discussed more fully in Unit 2.6 Driving in Extreme Conditions

Watch Air Pressure

- If air pressure falls low enough, brake failure or lockup (if spring brakes) may occur
- Emergency procedures to be discussed in Unit 3.2

Pay Attention to Signs

- Because they are dangerous many downhill grades warned by signs
- Warning signs indicate
  - Length and degree of decline
  - Need to use lower gears
  - Need to test air brakes
- Pay attention to warning signs and follow directions (e.g., downgrade of 1,000 feet, use lower gears for next 3 miles)

Recap of Information About Downhill Speeds

- Pay attention to signs
- Check brakes if necessary before going downhill
- Select the proper lower gear
- Downshift at top of hill
- Avoid downshifting when going downhill
- Use proper braking method
- Use engine brakes or retarders if available
- Don't let engine overspeed
- Keep the rig in position

Mountains will be discussed in more detail in Unit 2.6, Extreme Driving Conditions

4. SPEED AND VISIBILITY (15 minutes)

Visual 10 Effect of Speed on Sight Distance

Speed and Sight Distance

Adjust speed to how well you see ahead
Must be able to stop within distance you see
Rule: Sight distance must not exceed stopping distance

EXAMPLE: Driving a combination at 50 mph
Approximate stopping distance on dry pavement is 375 feet
Conditions limit view of road ahead to about 250 feet
Your speed must be reduced to 40 mph or less
Approximate stopping distance at that speed is 250 feet

Visual 11 Effect of Speed on Field of Vision

Speed and Field of Vision

Increased Speed Also Reduces Field of Vision

- Field of vision includes peripheral vision
- Area you can see without turning head
  - 20 mph equals 102°
  - 40 mph equals 70°
  - 60 mph equals 42°

How this Affects Driving

- Faster you go the less you see to the sides without turning head
- Have less time to react to hazards as they come into field of vision

Visual 12 Speed and Darkness

Adjusting Speed to Reduced Sight Distance

Darkness

- Headlights (low beams) illuminate the road ahead about 250 feet
- Stopping distance for tractor-trailer at 40 mph is 250 feet
- Safe speed when depending on headlights alone for lillumination is 40 mph

Rule: Don't overdrive headlights
Hazards that require you to stop won't be seen in time
Not enough stopping distance
Same as driving blind

More detailed discussion of night driving in Unit 2.5

Weather Conditions

- Sun glare
  - Cuts sight distance
  - Hides hazards
  - Reduce speed to have time to react to hidden hazards

- Rain, fog, snow
  - Adjust speed in bad weather for visibility ahead
  - Visibility can be cut to 100 feet by snow, fog, etc.
  - Safe speed for 100 foot signs distance is 20-25 mph
  - To drive faster is to overdrive one's eyes
  - Similar to overdriving headlights at night

- When it is not safe at any speed
  - Visibility can be reduced to where it is unsafe to drive
    - Dense fog
    - Blinding snow
    - Heavy downpour
  - Pull off and wait until there is enough visibility

Visual 13 Speed and Road Characteristics

Road Characteristics

- Hills and curves restrict sight distance
  - Driver doesn't know what is on the other side of steep hill or sharp curve
  - Adjust speed for the unexpected (e.g., stalled car on the other side of a curve)
- Intersections
  - Adjust speed when
    - Approaching blind intersection
    - View of side obstructed by trees, bushes, buildings
  - Drive slowly enough to react to vehicle that pulls out suddenly

Recap

Be aware of conditions and situations that restrict sight distance
Reduce speed to accommodate limited sight distance

5. SPEED AND TRAFFIC FLOW (10 minutes)

Visual 14 Speed and Traffic Flow

Influence of Traffic on Speed Management

Axiom: Vehicles moving in same direction at same speed can't collide

General Rule: Blend with traffic around you

Going Too Fast for Traffic Flow

Reasons

- In a hurry
- Using vehicle to bully smaller vehicles
- Built up too much speed coming down incline

Effects

- Frequent lane changing and passing to maintain speed
- Tailgating and approaching other vehicles too rapidly
- Excessive fuel and break usage
- Saves very little time

Consequences

- Increased chances of conflict, sudden stops, accidents
- Causes other drivers to react unsafely (e.g., small vehicle being tailgated might change lanes unsafely)

Control Methods

- Don't use the size of vehicle offensively, drive defensively despite large size
- Plan ahead so you won't have to hurry
- Keep an eye on speedometer coming down inclines, takes longer for larger vehicles to decelerate

Going Too Slow for Traffic Flow

- Problem for heavy vehicles
- Can be as dangerous as going too fast
- Forces other drivers to
  - Pass
  - Change lanes
  - Tailgate

If Driver Cannot Maintain Speed

- Pull off road if traffic builds up
- Keep to the right when going up incline

Visual 15 Speed For Entering Traffic

Speed Management When Entering and Exiting Traffic

Entering Traffic

- Need to accelerate to speed of traffic flow
- Larger vehicles do not accelerate as quickly as smaller ones
- Enter as quickly as possible to avoid reaching end of access lane
  - Watch mirror for vehicles approaching alongside
  - Most will change lanes if traffic permits
  - Vehicle signal will indicate intention to change lanes
  - Some drivers will fall back to admit tractor-trailer
- Enter as soon as gap is available
  - Avoid reaching end of acceleration lane
  - Adjust speed on acceleration lane if necessary

Hazards of Freeway Exit

- Frequent accident site for trucks
- Ramp often curves more than expected
    - Curvature often not visible
    - May curve sharply due to limitations in available space
- Driver frequently misjudges speed
    - Prolonged operation at high speed causes "Velocitization"
        - Term means getting adapated to high velocity (speed)
        - High speed feels like slower speed
        - Driver enters exit at too high a speed
    - Driver needs to check speedometer
- Posted speeds not always suitable for tractor-trailers
    - Exit speeds generally posted for automobiles
    - Tractor-trailers have higher center of gravity than autos
- Excessive deceleration (sudden slow down) also hazardous
    - Slowing on highway unexpected by following vehicles
    - Frequent cause of rear end collision or jackknifing

Exit Procedure

- Maintain posted speed on main highway
- Enter deceleration lane as early as possible
    - Apply brakes as necessary for approach to ramp
        - Use controlled braking to prevent skid
        - Control braking procedures to be described in Evasive Maneuvers (Unit 3.2)

6. OBEYING THE SPEED LIMIT (20 minutes)

Visual 16 Basis of Speed Laws

Speed Limits Based on Principles of Speed Management

- Sight distance limitation (hills, approaching intersections, etc.)
- Reduced traction (type of road surface)
- Space limitation (amount of traffic and number of lanes)
- Safety record (number of past accidents in given area)
- Type of vehicle
    - Lower speed for heavier vehicles required in many areas
    - Takes into account longer stopping distances
- Illumination (lower nighttime speeds)
- Fuel economy (55 national maximum speed limit)

Reasons for National Speed Limit

Fuel Economy

- Introduced as fuel economy measure in 1974
- Savings in fuel and dollars have been substantial

Safety

- Greater benefits derived in area of safety
- Number of accidents and severity have been reduced
    - First 3 year period (1974-1976) fatalities dropped by 9,000 per year
    - Disabling injuries to head and spine reduced dramatically

Two Basic Reasons Why 55 Saves Lives

- Decreased speed differences between vehicles, cuts down the number of high speed passes
- Gives driver more time to spot and react to hazards

NOTE: Fatalities have been on the rise in areas where 55 speed limit is not enforced.

Visual 17 Speed and Risks

Speed and Risks

What Are the Risks of Speeding?

- Accidents more likely at higher speeds
- Fatalities increase as speed increases
    - Chance of death doubles as speed increases from 55 to 65
    - Chance of death triples as speed increases from 55 to 75
- Fatal accident risks for heavy vehicles also greatly increased with speed
- Chance of inflicting death or disability on others increases too (particularly for heavier vehicles)

Why Does Greater Speed Increase the Chances of an Accident?

- Travel further before spotting a hazard
- Travel further before reacting to a hazard
- Overall stopping distance is increased
- Vehicle handling is more difficult
- Ability to cope with vehicle emergency reduced

Why Does the Severity of Injury Increase with Speed?

- Deaths and injuries occur when driver or passenger collides with windshield, steering wheel, as result of impact
- Higher the speed at which accident occurs, the greater the impact
- Greater the impact, the more severe the damage to individual
- Death, disfigurement, disabling injuries more likely to occur at higher speed

Visual 18 Speed Penalties

Penalties for Speeding

Accidents and physical injury are not the only risks

Traffic Tickets

- Speeding brings chances of getting tickets
- Consequences of ticket
    - Fines
    - Higher insurance rates
        - Premiums can be increased 2-4 times
        - Basis for loss of job
    - License suspension
        - Inability to drive
            - Can't operate truck legally
            - Operation on suspended license is a criminal offense
        - Loss of job
    - Some States report commercial driver's traffic violations to employers

Higher Maintenance Cost

- Tires wear our faster at higher speeds
    - Heat is number one enemy of tires
    - Sustained high speeds increase heat and decrease tire life
    - Strength and wear resistance are reduced
    - Chance of tire fire increased
- Brakes wear out faster at higher speeds
    - Chance of wear or fade increases
    - Overheating increases when applied at higher speeds
    - Applying brakes at 70 mph increases wear 30 percent over 50 mph
- All maintenance costs go up
    - Engine heat and overall wear are increased as speed increases
        - Gears
        - Bearings
        - Clutches
        - Suspensions
        - Transmissions
    - Maintenance costs increase dramatically with speed
        - 38 percent as speed increases from 50 to 60
        - 80 percent as speed increases from 50 to 70
    - Maintenance costs, like fuel costs, are rising in general
    - Important to drive vehicle properly to keep all costs down

Fatigue

- Driver becomes tired more quickly from
    - Fighting traffic (continually trying to pass others)
    - Noise and vibration (they cause fatigue even when driver gets used to them)
    - Watching for police (alertness is good; worry is tiring)

Fuel Economy Penalties

- High fuel costs make speed management vital
- Ideal speed for today's tractor-trailers on freeway is 50-55
- Power and fuel required to increase speed multiplies sharply
    - 73 percent more horsepower needed to cruise at 60 mph
    - 159 percent more horsepower to cruise at 70 mph

- Fuel costs go up greatly
    - Fuel loss of 1/10 mpg at each mph over 50 mph
    - EXAMPLE: Vehicle getting 8 mpg at 50 mph gets 7 mpg at 60 mph, additional 12,500 gallons of fuel will be used every 100,000 miles

    Student Exercise: Let the students discover themselves the extra cost of driving at 60 vs. 50 mph. Have them multiply current diesel or gasoline prices by 12,500 gallons. If vehicle drives 100,000 miles per year, this will be the additional cost of driving at 60 vs. 50 mph.

Poor Public Image

- Motorists seeing speeding truck gain bad impression
    - Of trucking industry
    - Of employer
- Professionalism dictates adherence to speed limits
    - Truly professional drivers do not speed
    - Speeding drivers don't last long enough to become professionals
- Irate citizens may report driver to employer
    - Employer can easily identify driver from time and location
    - May result in loss of job
    - To be discussed further in Unit 5.7, Public and Employer Relations

Visual 19 Example of Speeding

Why Drivers Exceed Speed Limit

Drivers exceed limit because they believe they will
- Shorten trip time
- Make up for lost time

- Tests show time savings are rarely significant
    - Little or no time is saved on short trips
        - Need to stop-and-go, cut in and out of traffic
        - Possibly time savings cut to a few minutes in an hour of driving

    - Not as much time is saved in longer trips as drivers believe
        - Difficult to average steady higher speed
        - Traffic flow causes driver to change lanes and speeds frequently
        - Areas of high enforcement make ticket risk great
        - Faster driver in example saved only 1-1/2 minutes an hour

    - Risks can cause time loss rather than time savings
        - Chances of ticket or accident greatly increased over 55 mph
        - Time will be lost if stopped by police or accident

Avoid the Temptation to Speed by Planning Ahead

Don't waste time so you won't be tempted to speed
Plan trips to avoid the need to make up time
    Get started on time
    Maintain a steady pace
    Plan rest stops
    Don't linger over that second cup of coffee

Recap

Speed increases the likelihood of a traffic accicent
The greater the speed, the more likely a death will occur

The first rule is obey speed laws
55 mph has positive benefits
    Reduced accident and fatality risk
    Substantial savings in fuel and maintenance costs

Potential benefits from exceeding 55 greatly outweighed by risks/costs (e.g., speeding ticket or accident will cost time)

7. CLASS DISCUSSION: PROBLEMS CREATED BY SPEED (15 minutes)

No Visual

Purpose and Method of Discussion

To summarize and reinforce principles discussed in class

Questions for Discussion

Use the questions below to lead short discussion

What are the four basic reasons for adjusting your speed?

How does increased speed affect your ability to see? to handle your vehicle? to stop in time?

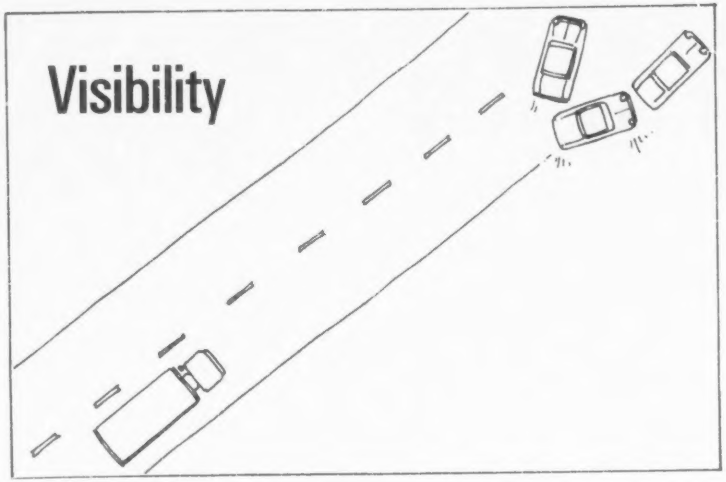
What are some of the situations and conditions that require you to adjust speed? surface conditions? weather conditions? conditions which affect sight distance? the shape of the road?

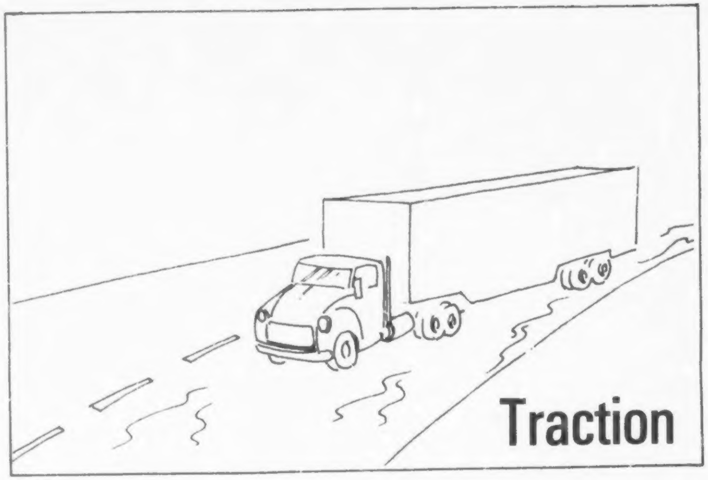
What are the risks of driving too fast for conditions when you pull a load around a curve? down an incline?

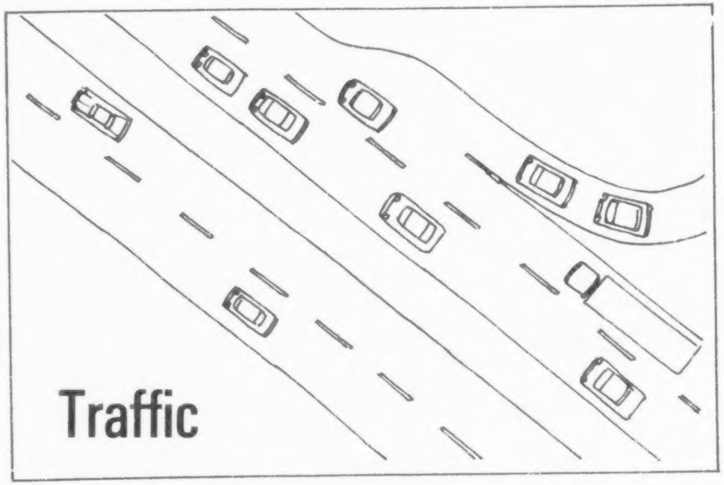
Cite some examples you have seen of poor speed management by tractor-trailer operators. What kind of problems or potential problems did they present?

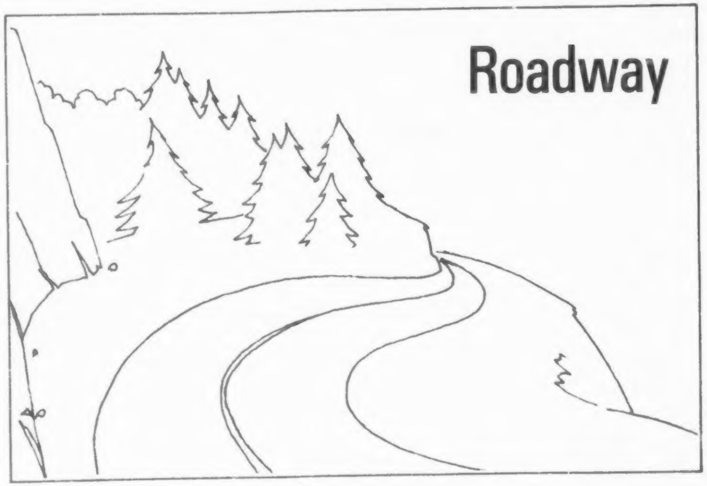
Visual 1

Adjust Speed For . . .


Visibility







Braking Distance

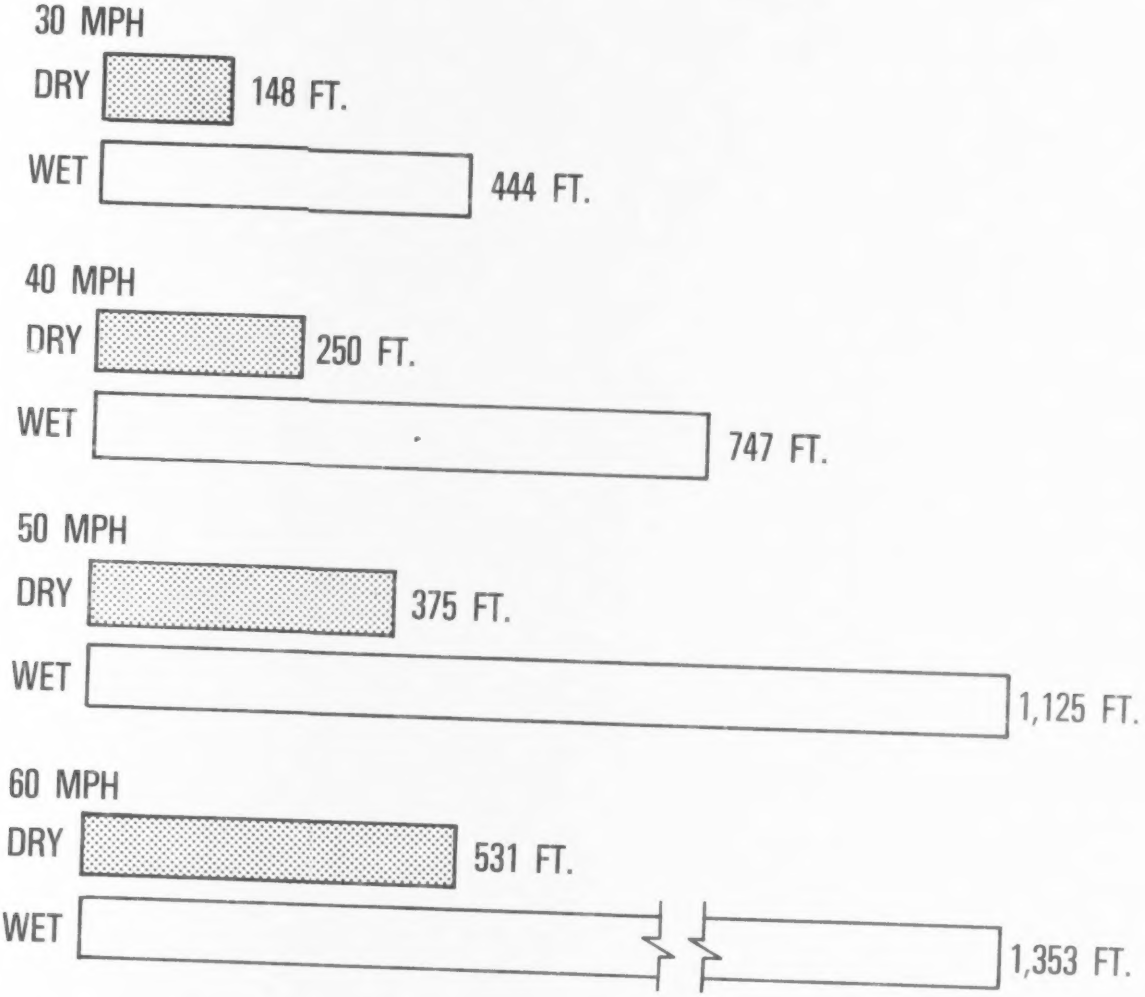
MPH	Distance For Cars	Distance For Tractor-Trailers
20	25	50
30	55	115
40	105	205
50	188	320
60	300	465

Response Time and Distance Traveled

Miles Per Hour	Feet Per Second	Response Distance	Braking Distance	Total Stopping Distance
20	29	22	50	72
30	44	33	115	148
40	59	44	205	249
50	73	55	320	375
60	88	66	465	531

Visual 4

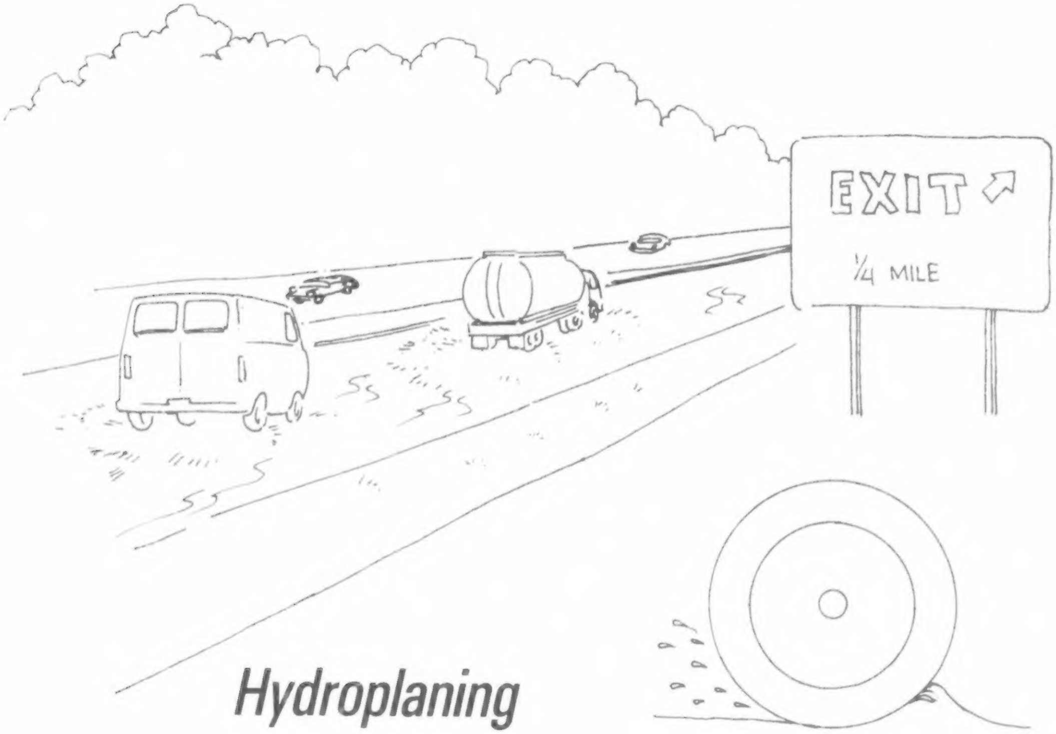
Stopping Distances Wet Vs Dry Pavements



Wet-Road–Cut Speed in Half to Stop in Same Number of Feet as on Dry Road.

Visual 5

Dynamics of Hydroplaning



Hydroplaning

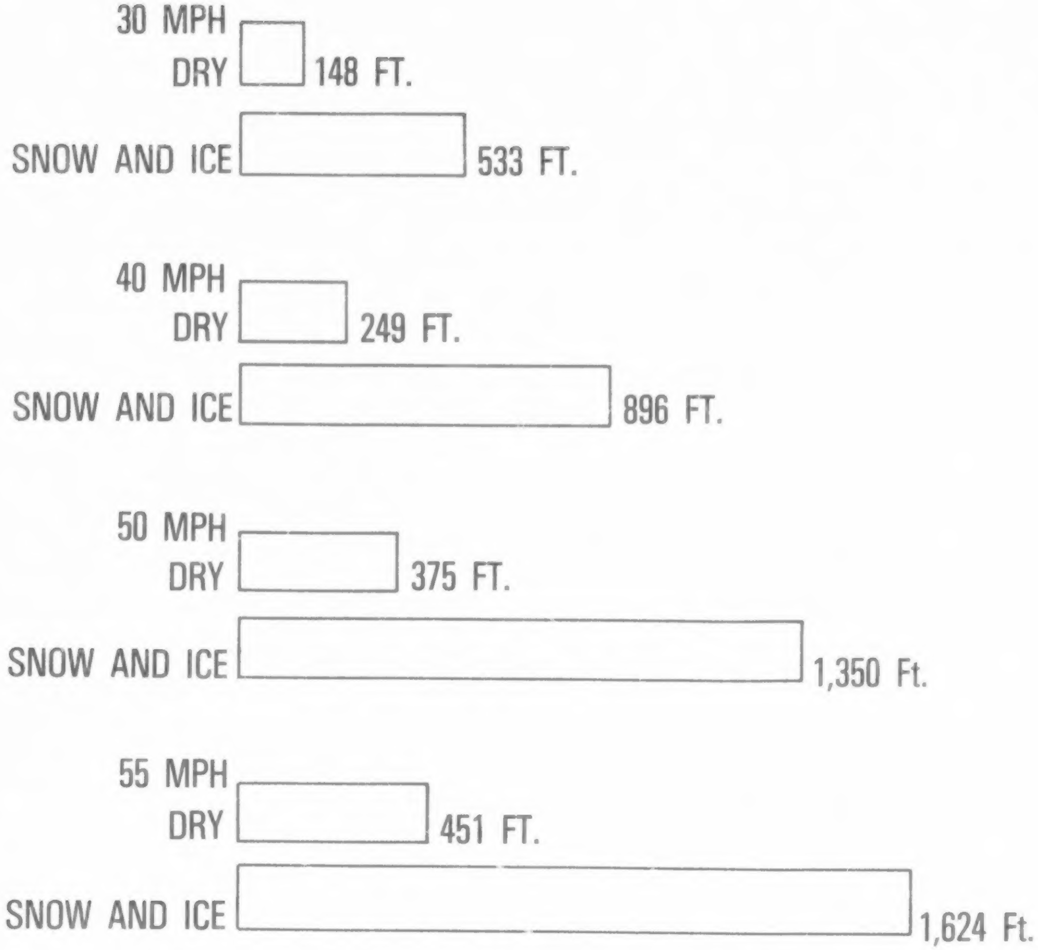
- Tires Not Touching Road

Steps

- Gradually Decelerate
- Don't Brake
- Don't Turn Wheel

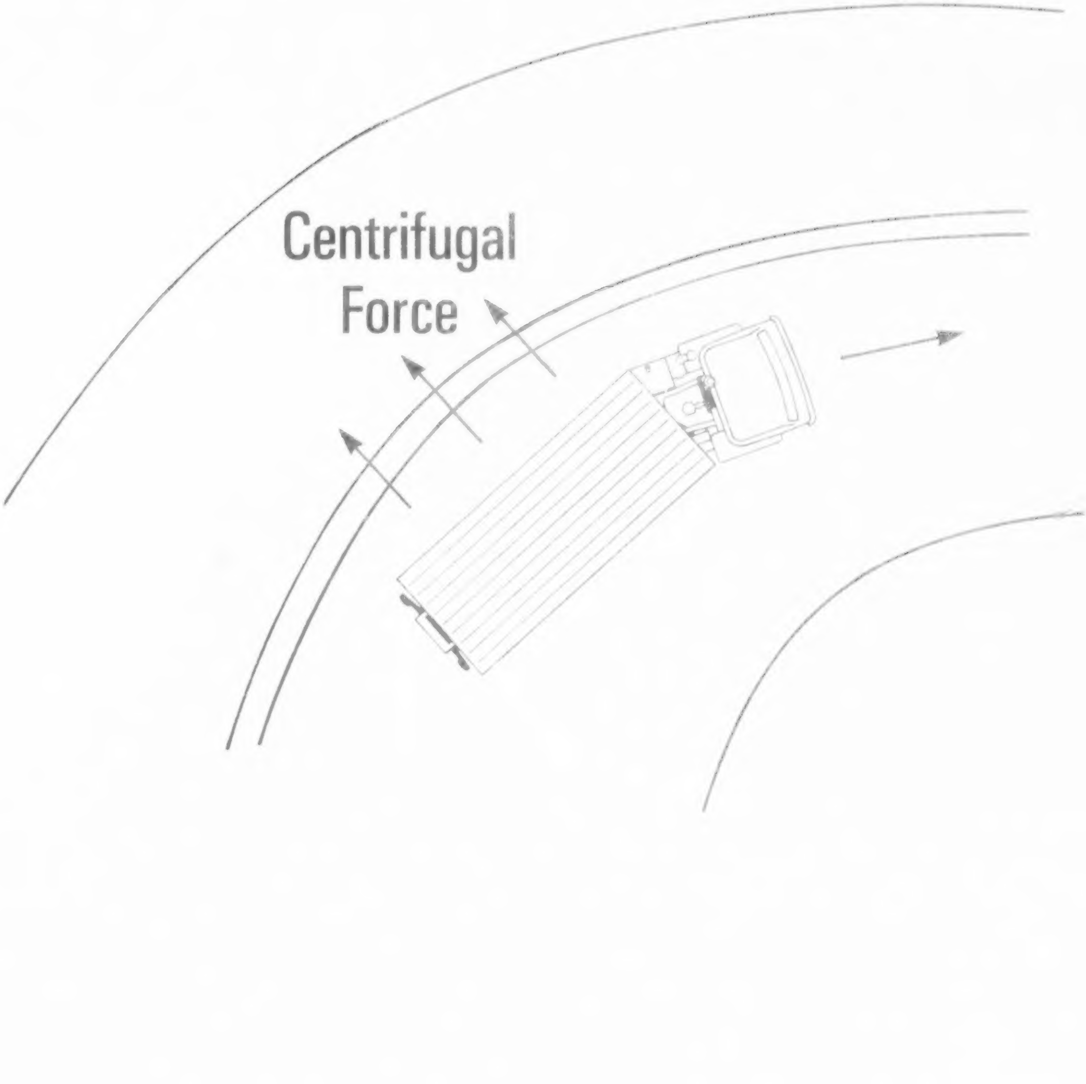
Visual 6

Stopping Distances—Snow and Ice



Visual 7

Centrifugal Force

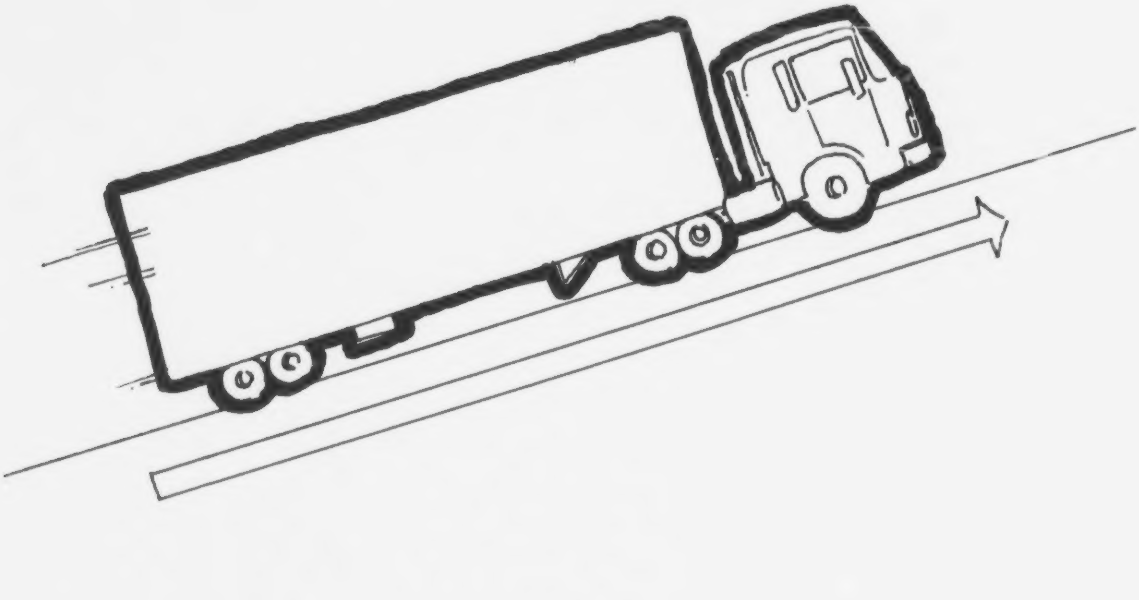

Centrifugal
Force

Visual 8

Handling Upgrades

Method:

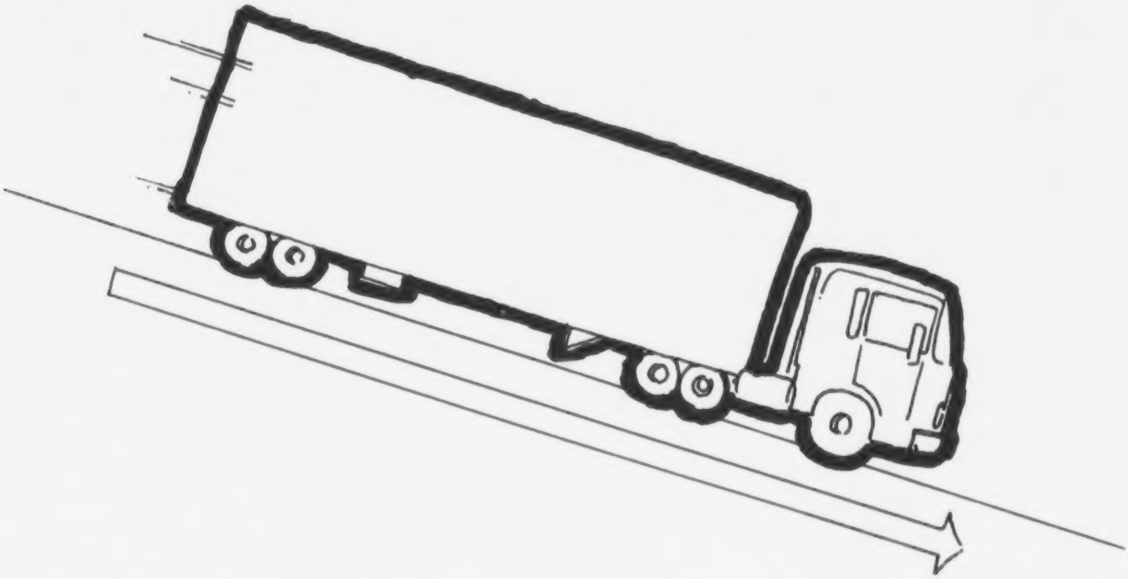
- Select Proper Gear
- Watch Temperature Gauge
- Keep to Right
- Do Not Impede Traffic
- Watch Tachometer
- Downshift
  - – Based on Engine Requirements



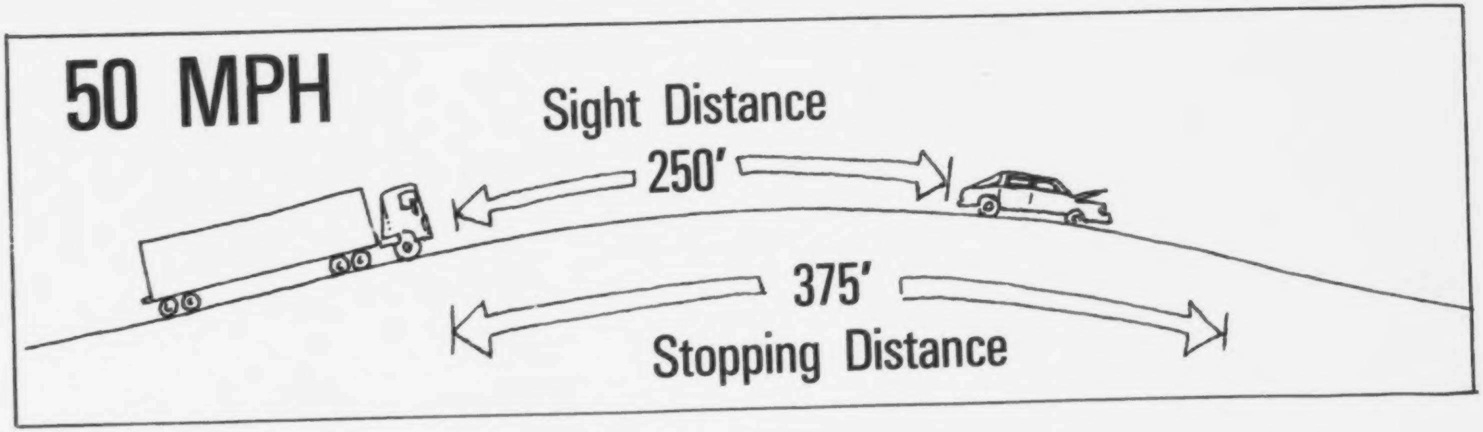
Visual 9

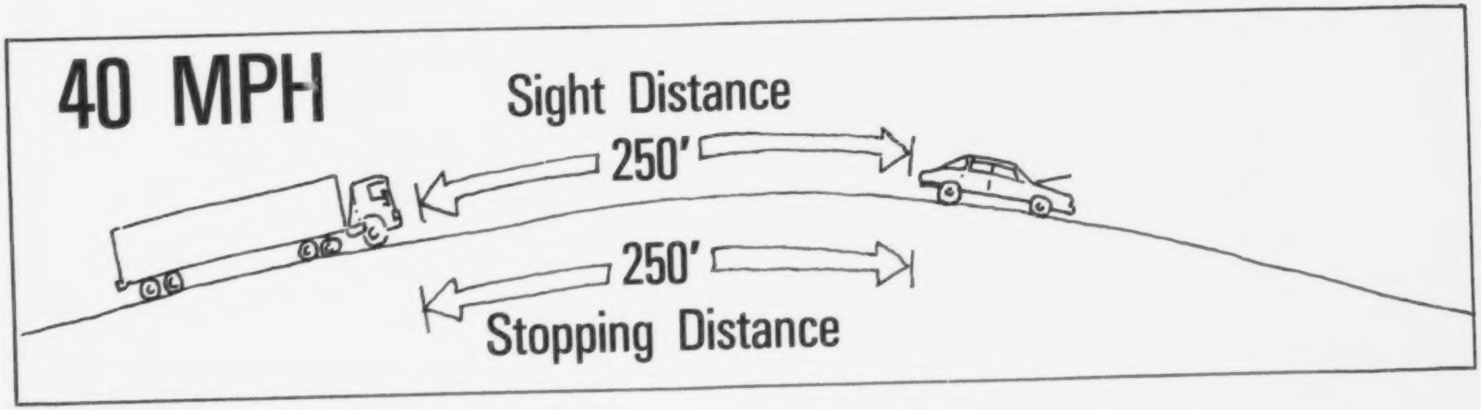
Handling Downgrades

- Start Down in Low Enough Gear
- Complete Shift Before Starting Down
- Maintain Light Brake Pressure
- Brake Only to Keep Engine Speed Within Safe Operating Range
- Use Engine Exhaust Brakes if Possible
- Watch Air Pressure



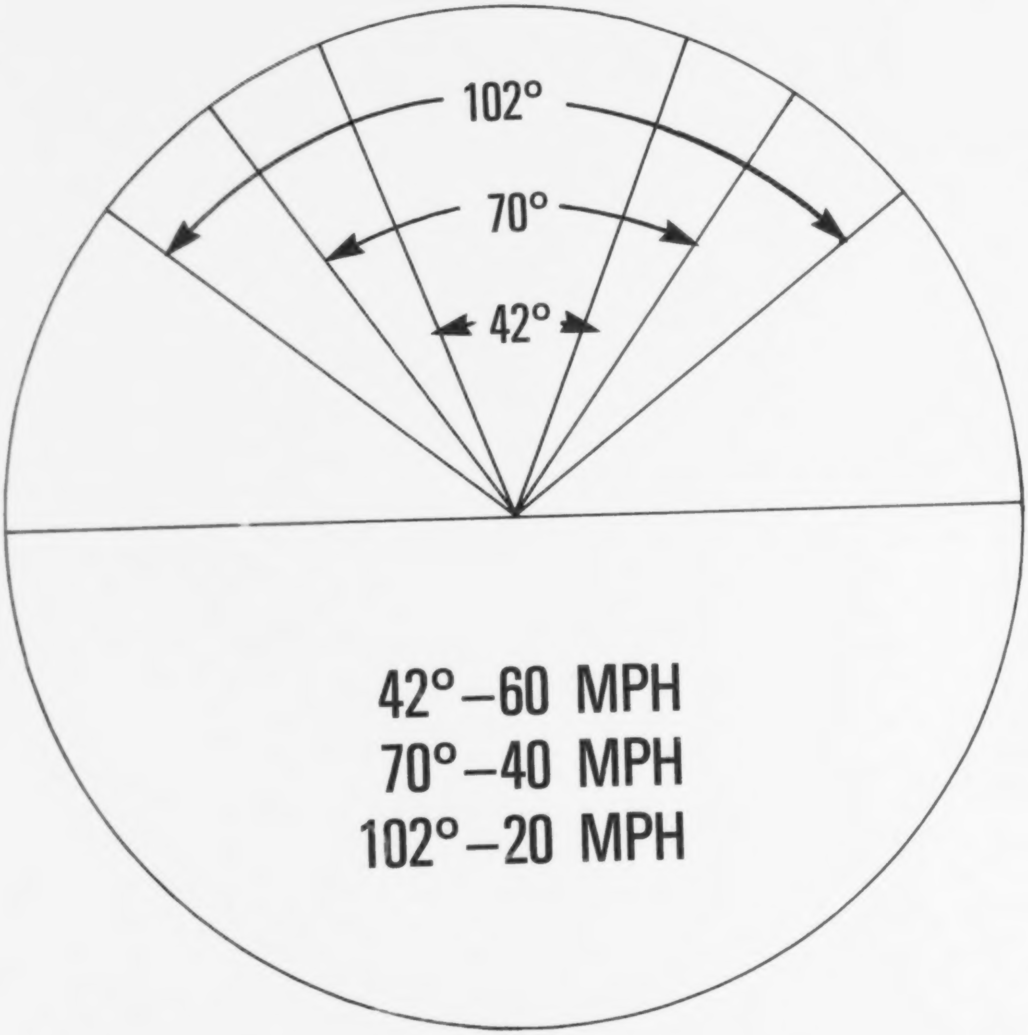
Effect of Speed on Sight Distance


50 MPH
Sight Distance
250'
375'
Stopping Distance

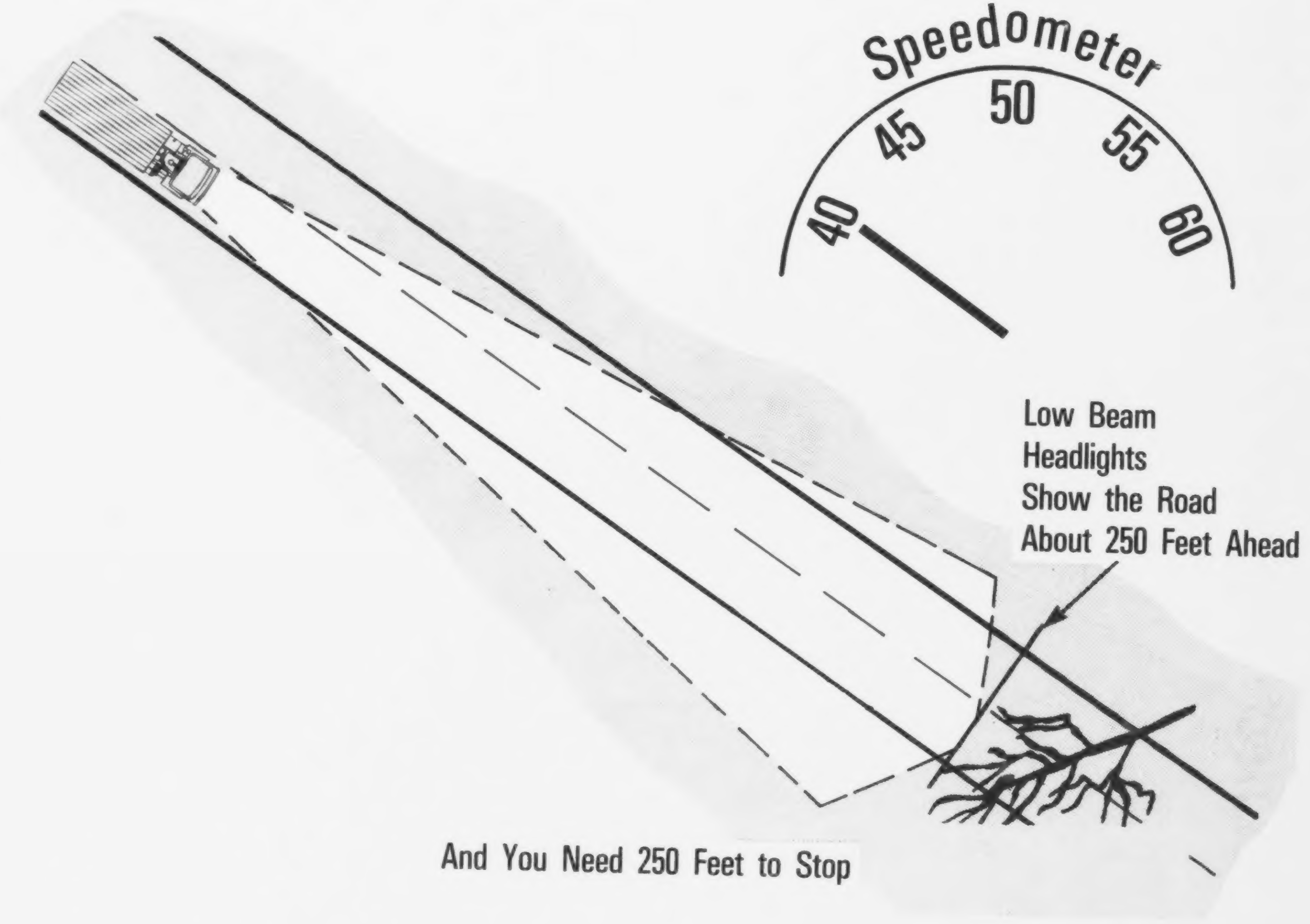

40 MPH
Sight Distance
250'
250'
Stopping Distance

Visual 11

Effect of Speed on Field of Vision

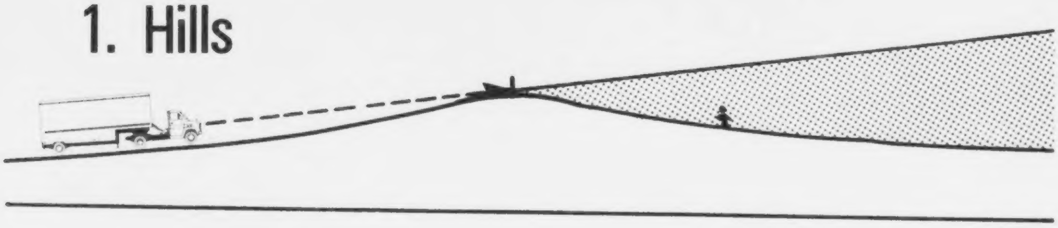

102°
70°
42°
42°–60 MPH
70°–40 MPH
102°–20 MPH

Speed and Darkness

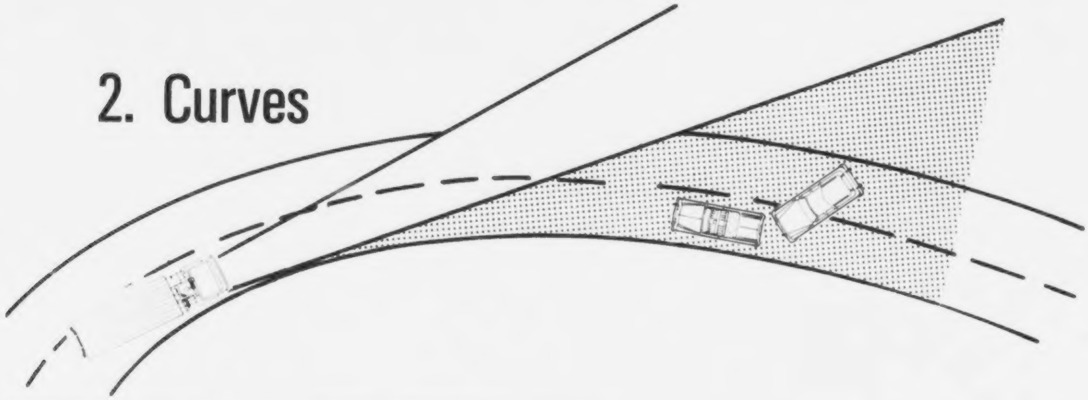

Speedometer
40
45
50
55
60
Low Beam
Headlights
Show the Road
About 250 Feet Ahead
And You Need 250 Feet to Stop

Speed and Road Characteristics

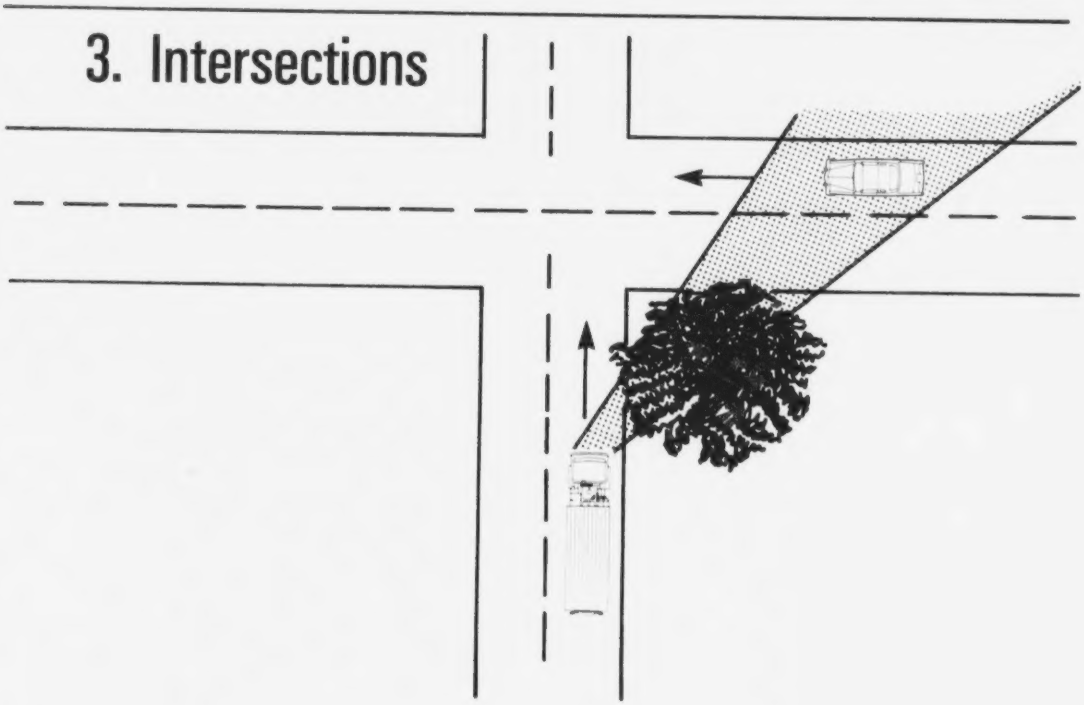
1. Hills



2. Curves

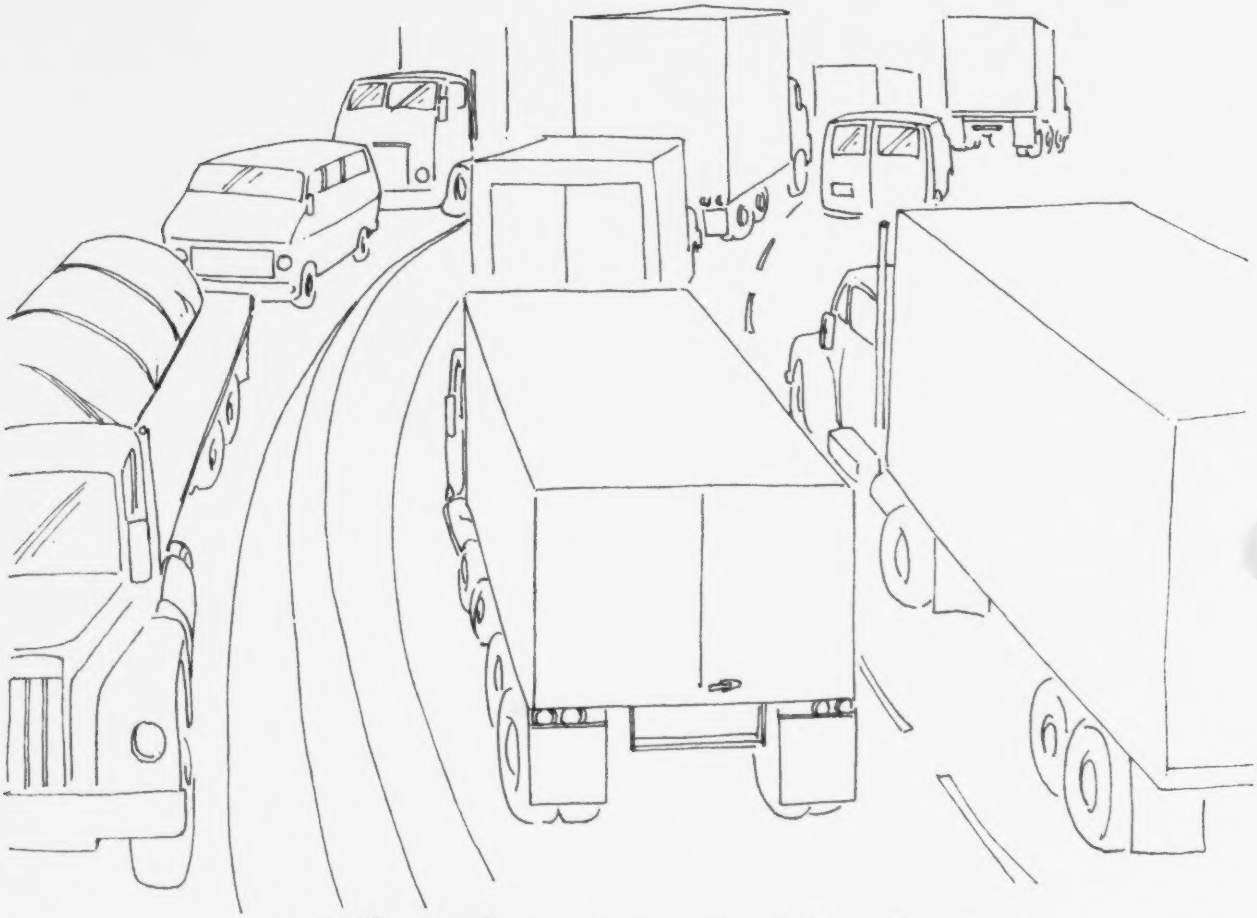


3. Intersections



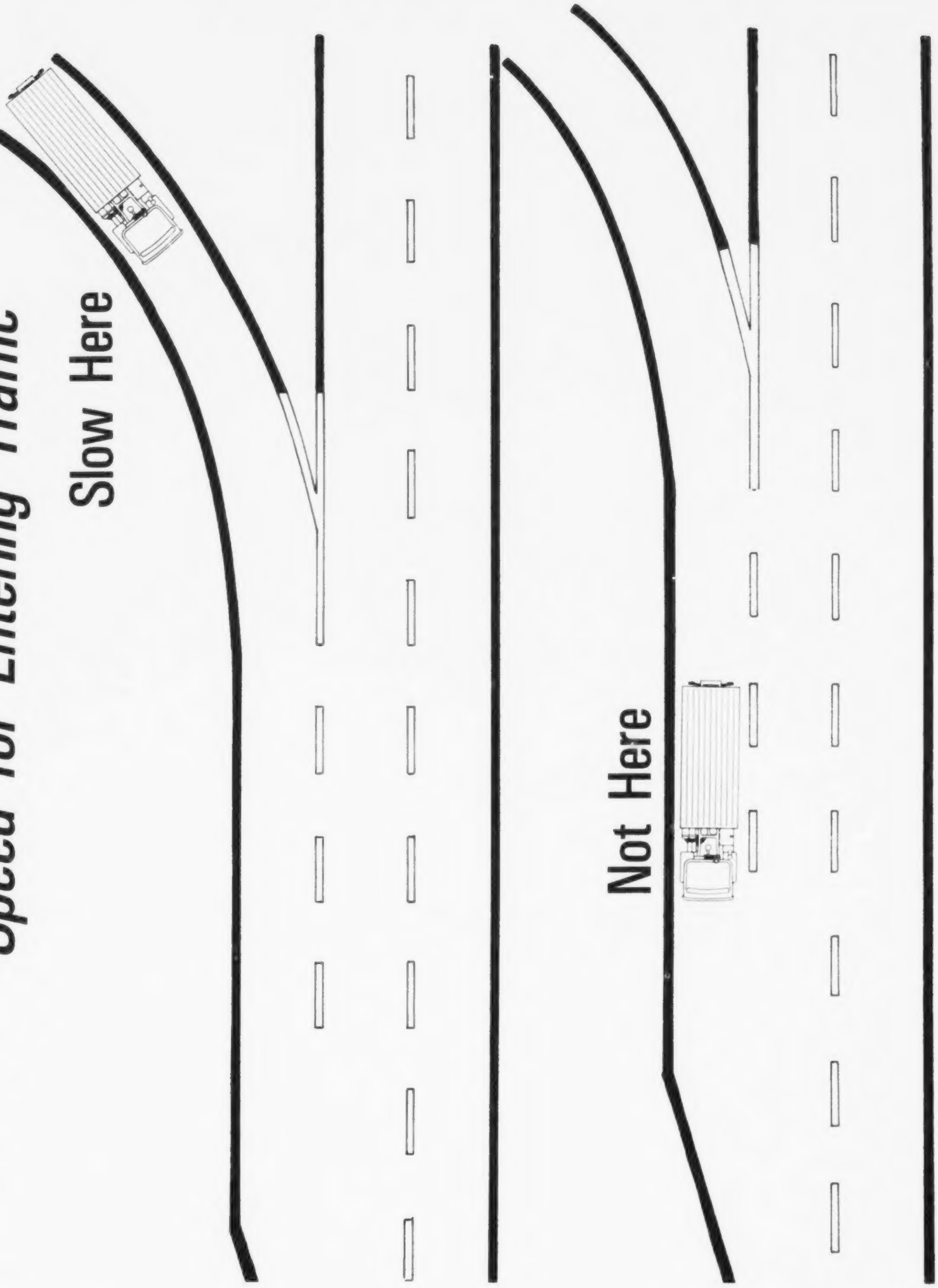
Visual 14

Speed and Traffic Flow



- Adjust Speed to Traffic Flow
- Avoid Frequent Lane Changing
- Avoid Frequent Tailgating
- Don't Hinder Faster Traffic

Speed for Entering Traffic


Slow Here
Not Here

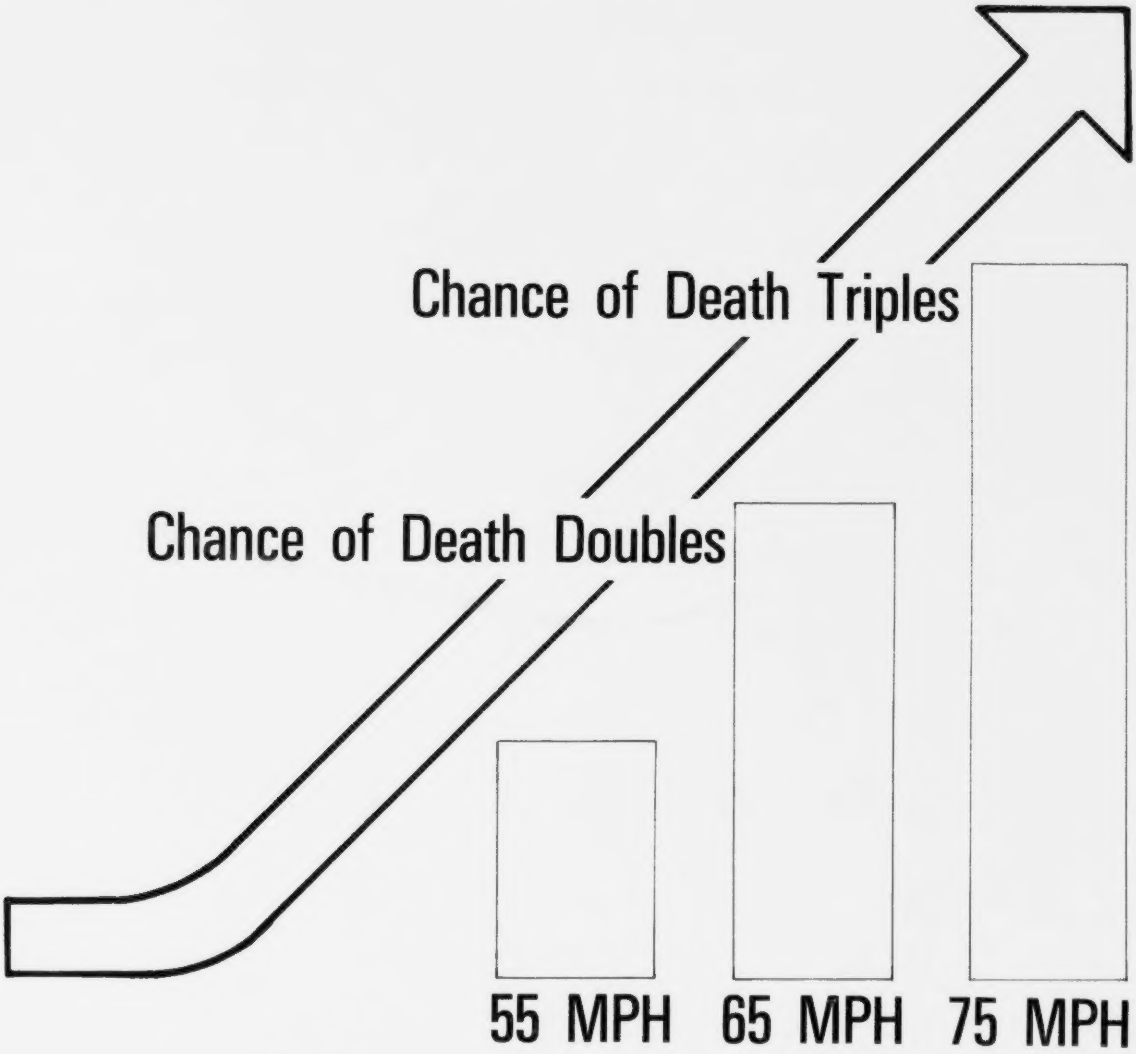
Visual 16

Basis of Speed Laws

- Sight Distance
- Road Surface (Traction)
- Space Limitations
- Safety Record
- Type of Vehicle
- Illumination
- Fuel Economy

Visual 17

Speed and Risks



Chance of Death Triples

Chance of Death Doubles

55 MPH 65 MPH 75 MPH

Visual 18

Speed Penalties

Traffic Tickets

- Fines
- Higher Insurance Rates
- License Suspension
  - Inability to Drive
  - Loss of Job
- Liability in an Accident

Maintenance

- Tires and Brakes Wear Faster
- Increased Cost With Speed

Fuel Economy

- Fuel Loss 1/10 Gallon Each MPH Over 50 MPH
- 12,500 More Gallons Used at 60 MPH

Fatigue

- Driver Becomes Less Alert
- Reaction Time Slows

Visual 19

Example of Speeding

An Actual Case Study

1,000-Mile Trip

Driver A	Driver B
Drove as Fast as Possible	Adhered to Speed Limit
Driving Time: 20 Hours and 12 Minutes	Driving Time: 20 Hours and 43 Minutes
Braked: 1,339 Times	Braked: 652 Times
Overtook: 2,004 Cars	Overtook: 645 Cars
Four Emergency Stops	No Emergency Stops

LESSON 2 SPEED MANAGEMENT DEMONSTRATION (RANGE)

Overview

Time Allotted: 1 hour 45 minutes

Prerequisites: Unit 2.3, Lesson 1

Purpose:

The purpose of this lesson is to demonstrate to the students the effects of speed on total stopping distance and vehicle maneuverability. A student will perform all demonstrations while other students observe and an instructor explains.

Materials

Instructional Aids

None

Student Material

No additional material required

Instructor Material

No additional material required

Equipment
Tractor-trailer equipped with a three-barrel brake detonator, for details of this equipment and its use, see the School Administrator's Manual section on Training Equipment and Materials.

Content

Activity or Topic	Approximate Time
1. TOTAL STOPPING DISTANCE DEMONSTRATION	60 minutes
2. VEHICLE MANEUVERABILITY DEMONSTRATION	45 minutes
	1 hour 45 minutes

1. TOTAL STOPPING DISTANCE DEMONSTRATION (1 hour)

Purpose

This demonstration will illustrate the effects of speed and vehicle weight on total stopping distance.

Range Layout

No special requirements.

Directions

1. A total of four demonstrations will be made, the same vehicle and driver should be used for all runs. The only difference in the runs will be the speed of the vehicles.

2. The four runs are

   - Vehicle Speed: 10 mph

   - Vehicle Speed: 15 mph

   - Vehicle Speed: 20 mph

   - Vehicle Speed: 25 mph

3. A student will drive the vehicle in all four demonstrations to give the demonstration credibility. An instructor will ride with him to control the demonstration and to perate the brake detonator, i.e., fire the first shot.

4. The remaining students and an instructor will observe from a safe distance. The instructor will explain the nature of the demonstration and point out the relationship of speed to driver reaction distance, vehicle braking distance, and total stopping distance.

5. The student driver will be instructed to stop as quickly as possible upon hearing the first detonater. As the student hits the brakes, the second detonater will go off.

6. The student driver will remain stopped at the end of each run long enough to mark the detonation points and the first stopping point with cones. The cones should be numbered to represent each separate run.

7. The observing students and instructor can then compare the reaction distance (first detonation point to second detonation point), the braking distance (second detonation point to final stopping point) and total stopping distance (first detonation point to final stopping point) for each run.

8. A measurement of each run should be made and recorded.

2. VEHICLE MANEUVERABILITY DEMONSTRATION (45 minutes)

Purpose

This demonstration will illustrate the effects of speed on vehicle maneuverability.

Range Layout

A serpentine course will be needed for this demonstration. See Range Diagram in Unit 1.8

Directions

1. A student driver will attempt to negotiate a serpentine course in three runs of increasing speed. The same driver and vehicle should be used each time to give the exercise credibility. A student driver is used because other students might feel that an instructor would drive poorly on the faster runs to influence the outcome of the exercise.

2. The runs will vary only in speed as follows:

   - Run 1 - 10 mph
   - Run 2 - 15 mph
   - Run 3 - 20 mph

3. The remaining students should observe at a safe distance while the instructor points out the differences in vehicle maneuverability in each run.

4. After the demonstration, discuss the effects that speed had on vehicle maneuverability.

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